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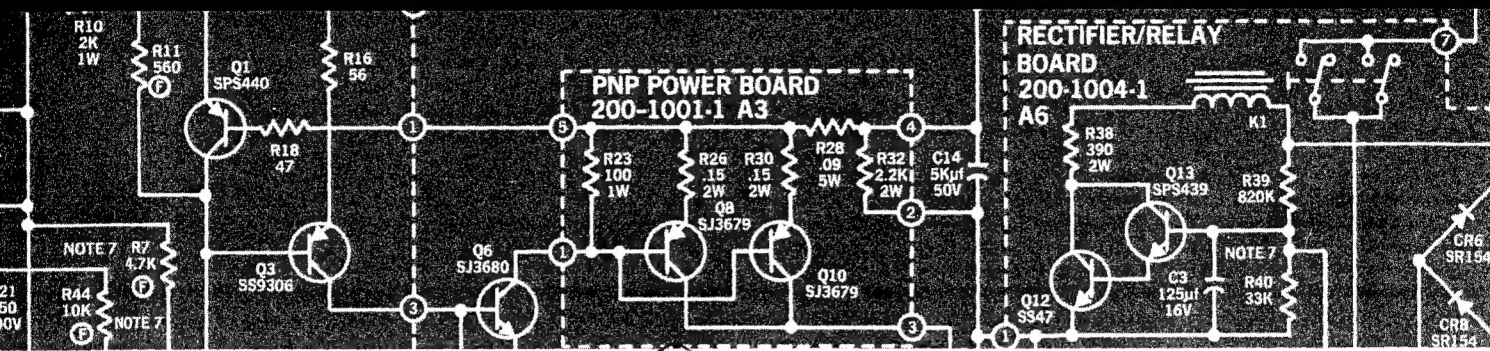

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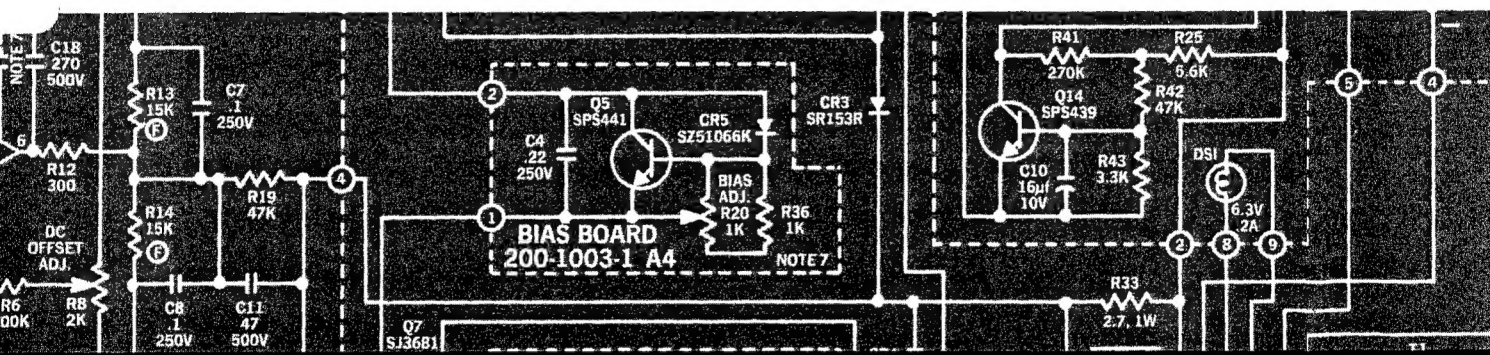
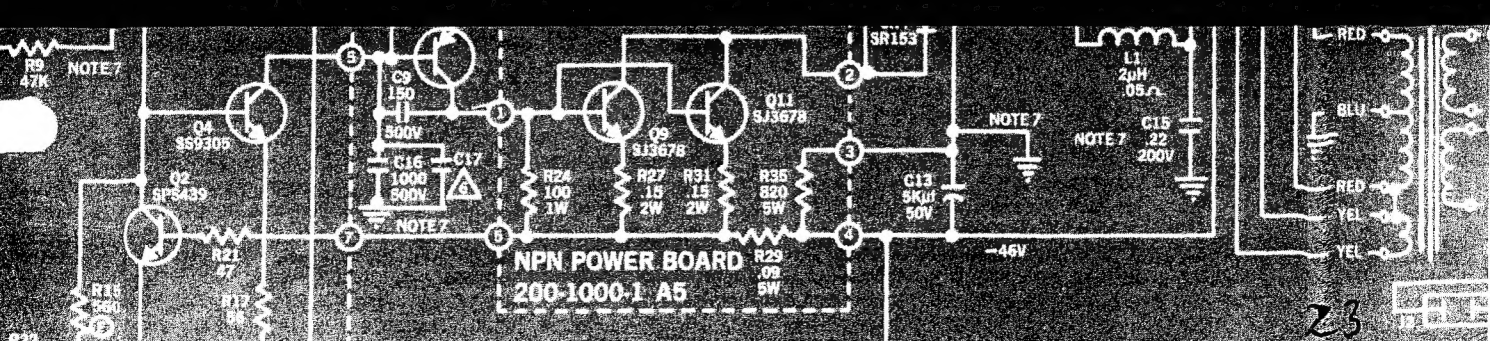
SERVICE MANUAL

16



Stereo Power Amplifier



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INTRODUCTION

This service manual is intended for use by Authorized Warranty Stations. The manual contains service information for the Marantz Model 16 and Model 16M audio power amplifiers, manufactured by the Marantz Corporation, a subsidiary of Superscope Incorporated, Sun Valley, California 91352.

Adjustment, maintenance, and troubleshooting information listed herein should be attempted only by the experienced technician, one knowledgeable in solid state amplifier operation and the use of test equipment. All instructions should be read carefully and understood fully before proceeding with any service.

Symptoms (and their remedies) listed in the Troubleshooting Section are those which might occur in some units. As the Marantz Company becomes aware of other field problems, supplementary service bulletins will be issued to all stations. To improve this service, all problems (and their solutions) not covered in this service manual should be brought to the attention of the Service Manager at our Sun Valley location.

> NOTE: Performance, specifications, testing, and trouble analysis in this manual apply to a Model 16M amplifier or to each of the two modules comprising a Model 16 amplifier.

CIRCUIT DESCRIPTION

AMPLIFIER (figures 1. and 2.)

The signal from V1 is applied to the inverting input (pin 2) of the operational amplifier (op amp) A1 through the input coupling network C1, R1, R2, and R4. This network provides a high input impedance to the amplifier and prevents any dc from appearing at the op amp input.

The output of the op amp is divided by networks C7/R13 and C8/R14, and is applied to the base of Q3 and Q4. Q3 and Q4 provide the voltage amplification necessary to drive the driver (buffer) transistors Q6 and Q7, (Figure 1). Q6 and Q7 are operated in a complementary-symmetry configuration with their respective power transistors Q8/Q10 and Q9/Q11. Capacitors C9, C16, and C17 in the base collector circuit of Q7 supress any parasitic oscillations that may occur during operation.

The output of Q6 is applied to the common bases of Q8 and Q10, and the output of Q7 is applied to Q9 and Q11. The combined operation of PNP transistors Q8 and Q10 and NPN transistors Q9 and Q11 provide a push-pull output appearing at diodes CR3 and CR4. This output is applied to network R33, L1, and C15 and via relay K1 contacts to the LOUDSPEAKER output terminals (TB1.)

To maintain overall amplifier stability and linearity, degenerative feedback is utilized throughout the amplifier. This feedback is also necessary to reduce distortion to within specified limits. R/C network R5, R3, and C2 condition the feedback signal for application to the non-inverting input (pin 3) of the op amp. The network comprising R19 and C11 provides necessary feedback to the bases of Q3 and Q4.

Except for the input, the amplifier uses direct coupling throughout. An offset voltage is applied to pin 3 of the op amp to nullify any undesirable dc output signal. The offset voltage is provided by R3, R6, R7, R9, and potentiometer R8. Resistors R7, R8, and R9 form a voltage divider between the plus and minus 15-volt source such that DC OFFSET ADJ. (R8) may be adjusted through a plus or minus 1.3-volt range.

POWER SUPPLY

A transformer-operated power supply (Figure 3) furnishes all ac and dc voltages. The transformer has dual primary windings, and may be operated on

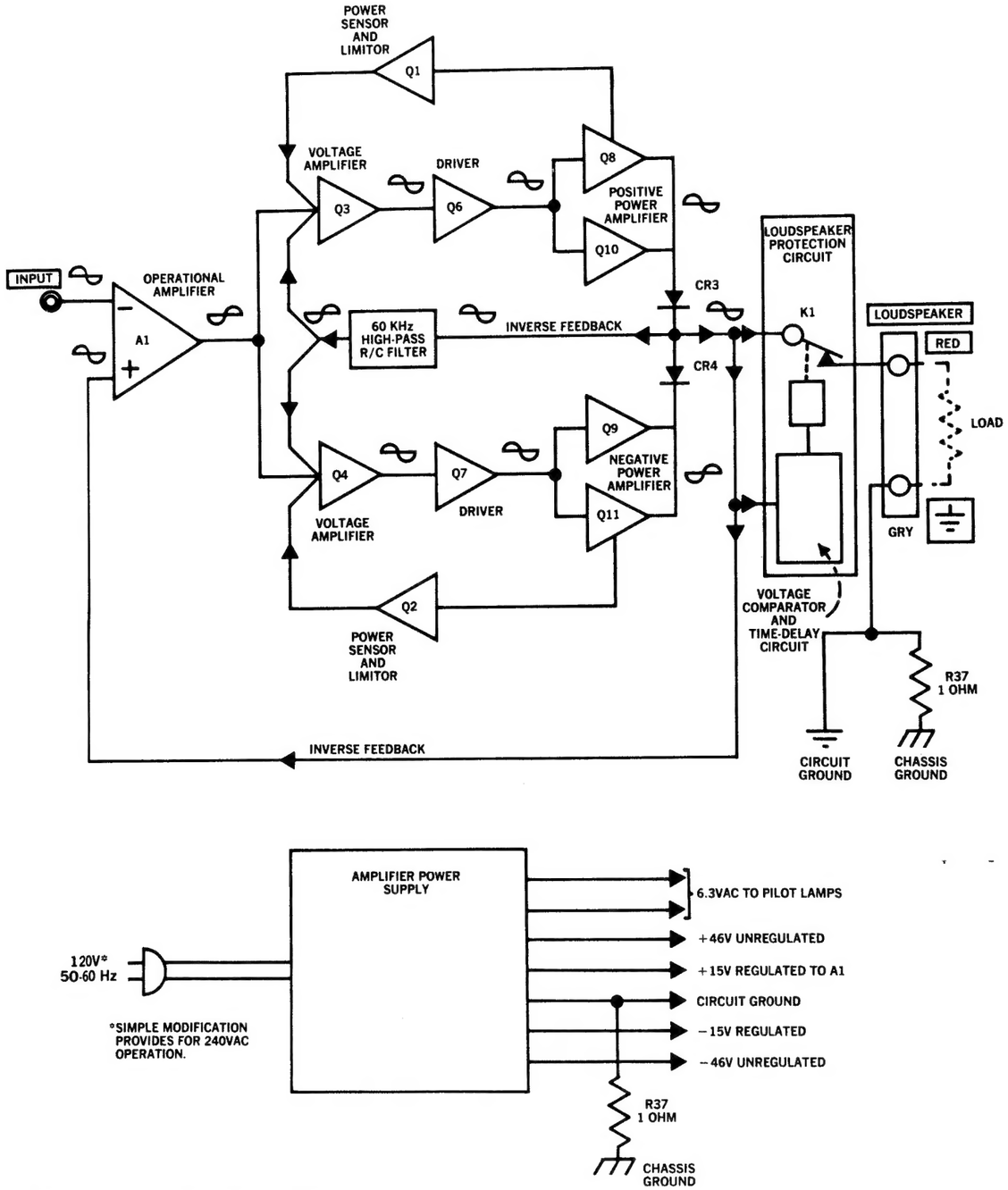
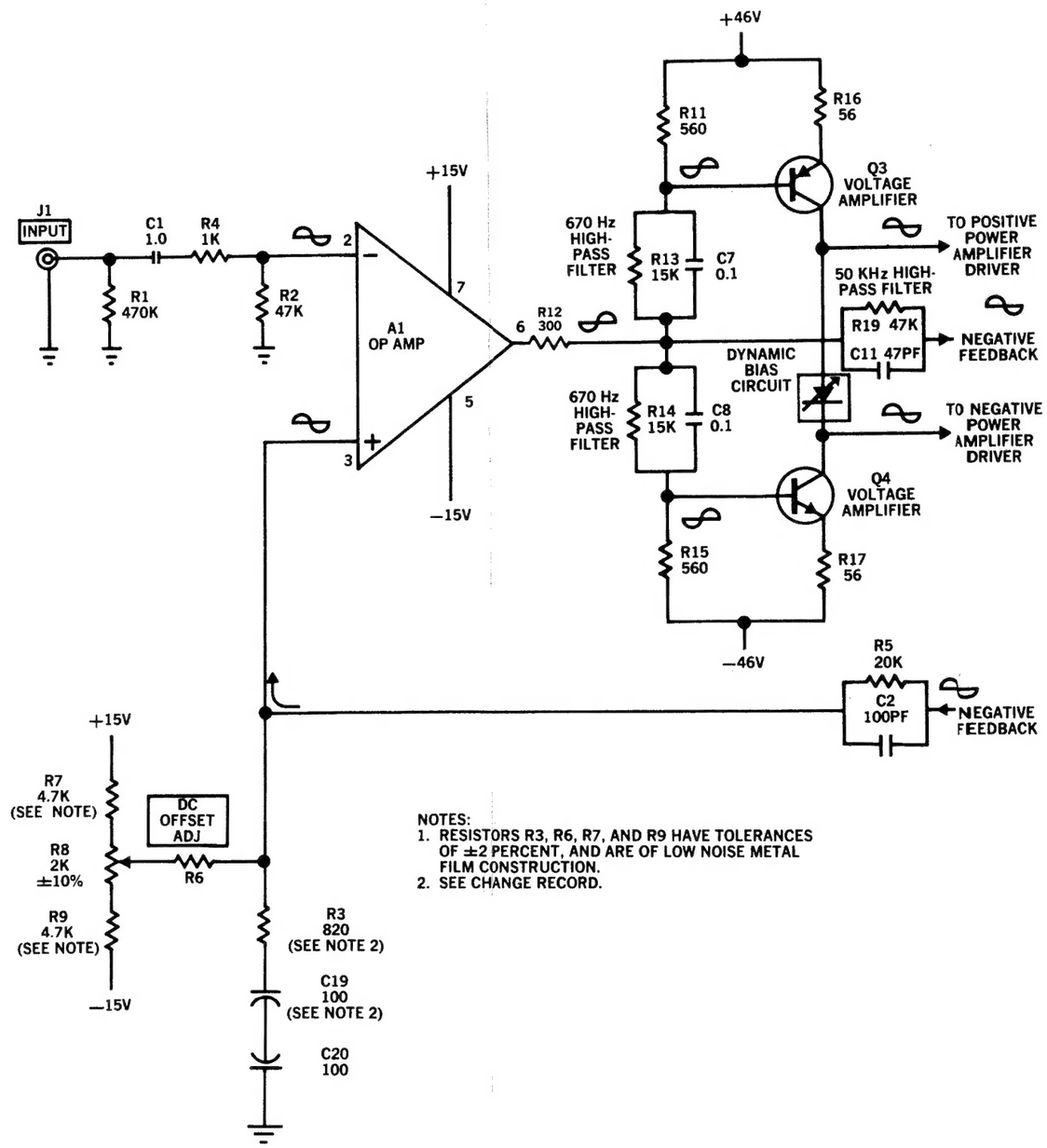


Figure 1. Functional Block Diagram.



NOTES:
1. RESISTORS R3, R6, R7, AND R9 HAVE TOLERANCES OF ±2 PERCENT, AND ARE OF LOW NOISE METAL FILM CONSTRUCTION.
2. SEE CHANGE RECORD.

Figure 2. Voltage Amplification, Simplified Schematic Diagram.

CIRCUIT DESCRIPTION (CONT'D.)

either 120 vac or 240 vac (Figure 6). A fuse in a bayonet-type holder provides protection to the primary winding. One secondary winding supplies 6.3 volts for the pilot lamps. The other secondary winding delivers power to a fullwave bridge comprising rectifiers CR6 through CR9, with the center tap circuit grounded (not chassis grounded). Since neither side of the bridge is grounded, the 90 to 100 volts of dc output appears as +45 to +50 volts and —45 to —50 volts, as referenced to circuit ground. Plus and minus outputs are each filtered with 5,000 microfarad capacitors C13 and C14. The filtered outputs are applied directly to all but the operational amplifier circuit, which receives plus and minus 15 volts from voltage dividers connected between ground and the 46-volt source. R10 and Zener diode CR1 provide a regulated output of +15 volts; R22 and Zener diode CR2 provide a regulated output of —15 volts. C5 and C6 filter the 15-volt source.

DYNAMIC BIAS (figure 4.)

Dynamic bias is applied to the bases of driver transistors Q6 and Q7. Q6 and Q7, in turn, determine the class of operation for the power amplifier (PA) transistors Q8/Q10 and Q9/Q11, thus maintaining a constant class of operation by establishing and maintaining the proper collector-to-emitter current. This dynamic bias circuit is comprised of Q5, R20, and temperature sensitive diode CR5. The circuit provides a variable base bias for driver transistors Q6 and Q7 that automatically maintains the proper base voltage (bias condition) with temperature change. Temperature sensitive biasing components of the dynamic bias circuit are thermally coupled through a heatsink to the driver and PA transistors. Driver bias is set while monitoring primary power consumption with no signal applied. When driver and PA stages are biased off, idle power consumption is about 15 watts; when biased on to the limit, power consumption is about 150 watts, and causes excessive heating of the power transistors. Correct adjustment of dynamic bias should result in about 35 watts primary power consumption.

PROTECTIVE CIRCUITS

LOUDSPEAKER PROTECTION. Contacts of relay K1 connect the output of the amplifier to the LOUDSPEAKER terminal. Positive power supply voltage is applied to R39 and to one side of K1 coil, with the ground return of K1 coil being through R38 and relay-driver Q12. When voltage is applied through R39 to the base of Q13, base voltage rises slowly as determined by the time constant of R40 and C3. Normally, in about ten seconds, the level of positive voltage at the base of Q13 is sufficiently great to cause relay K1 to energize.

Should either a positive or negative dc voltage or a high amplitude signal of less than 10 Hz be present at the PA output, K1 will de-energize, thus disconnecting the loudspeaker.

If an output fault should occur, K1 will remain de-energized during the normal time delay recycle (which happens only when the output returns to normal). If the faulty power output signal persists, as with an amplifier circuit failure, the output will remain disconnected from the loudspeakers.

AMPLIFIER PROTECTION (figure 5.)

Protection for the amplifier is provided by sensing-resistors R28 and R29 operating in conjunction with Q1 and Q2. When the output power transistors Q8/Q10 and Q9/Q11 are over-driven, and the output power exceeds an approximate 100 watts, the current increase through the power output transistors causes an increases current flow through R28 and R29. The resulting voltage drop across R28 and R29 controls the biasing of Q1 and Q2, resulting in the clipping of any input signal of greater amplitude than is required to cause the power output stage to deliver approximately 100 watts.

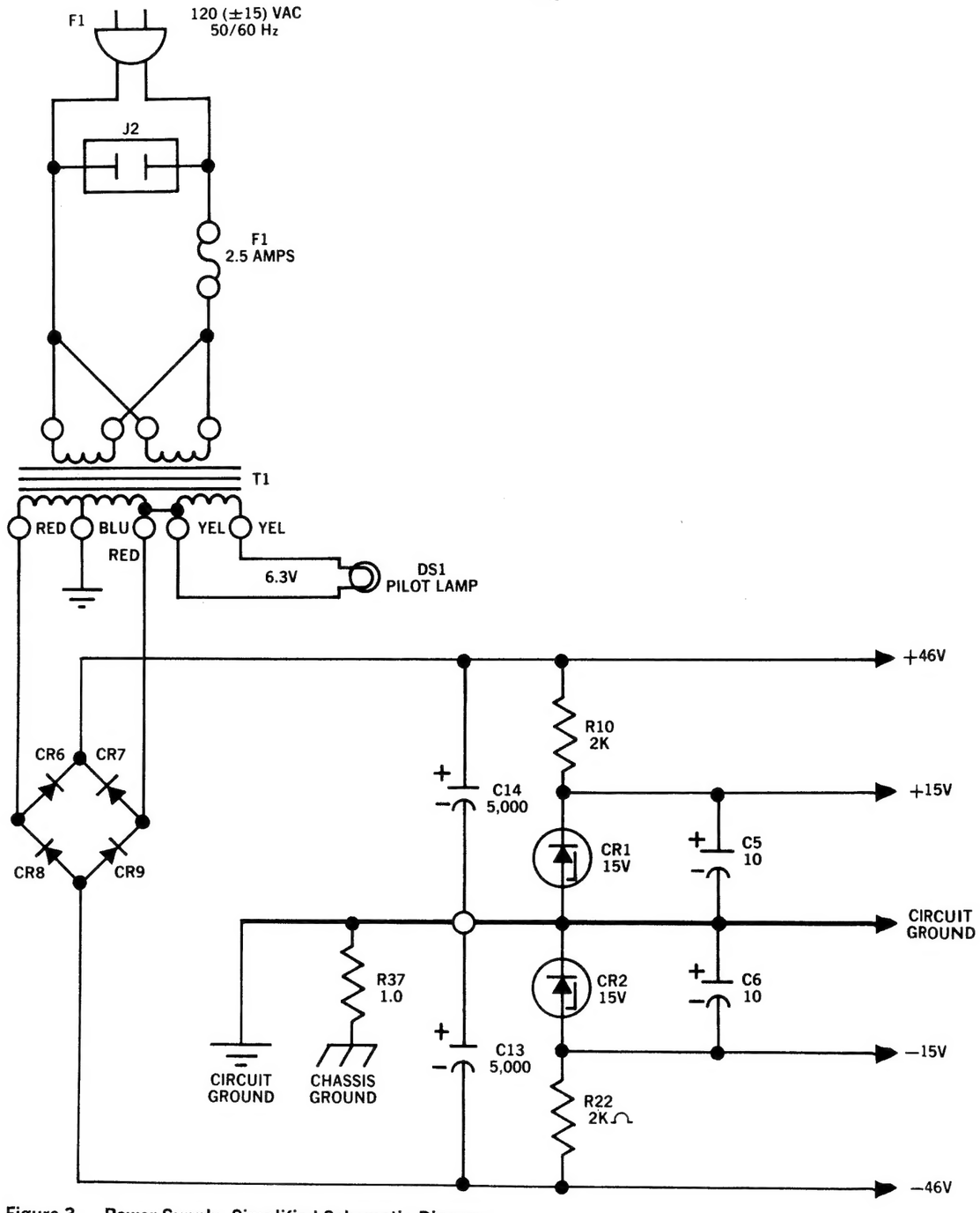


Figure 3. Power Supply, Simplified Schematic Diagram.

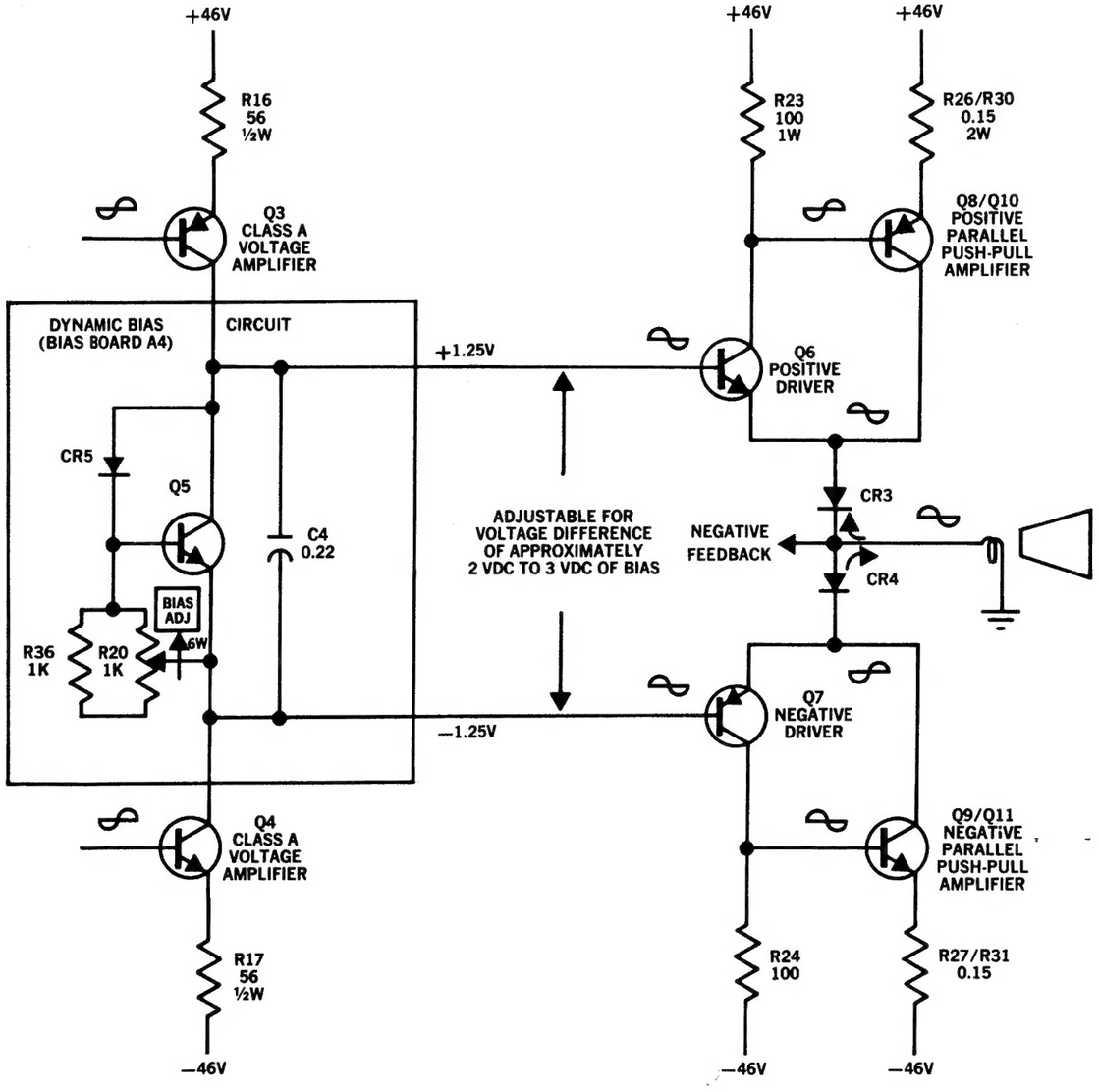


Figure 4. Biasing of Drivers and Power Amplifier.

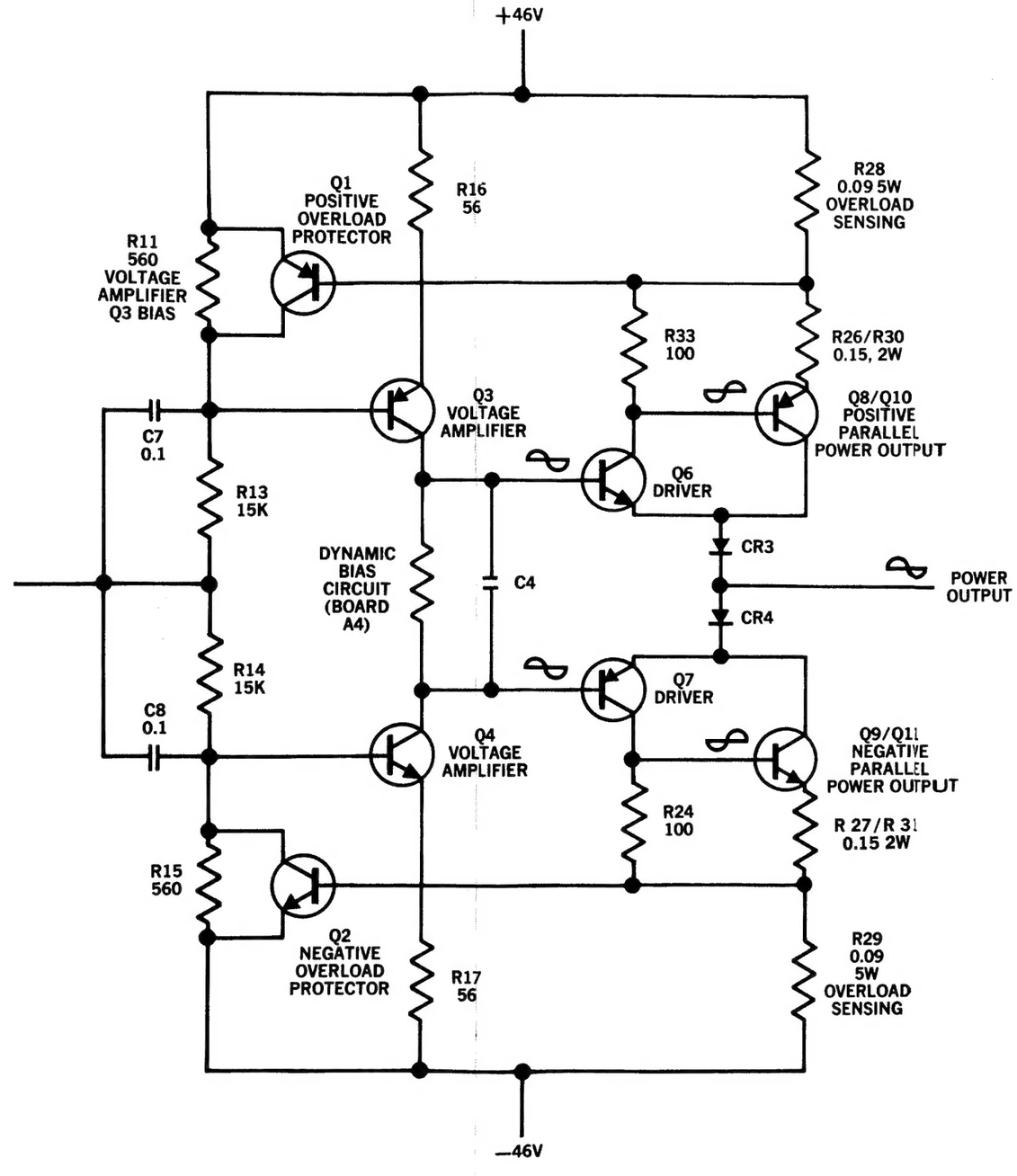


Figure 5. Amplifier Protection Circuit.

CONVERSION TO 240 VOLT OPERATION

To convert the Model 16 or Model 16M amplifier to 240-volt operation, proceed as follows. Refer to Figure 6 for connections both before and after conversion.

1. Remove back plate of amplifier module.

2. Install standoff insulator Part No. 359-1001 over the top of hex nut and onto 6-32 screw next to fuseholder that secures LOUDSPEAKER terminal.

3. Unsolder white transformer primary wire from convenience outlet J2, and resolder it to terminal of standoff insulator.

4. Unsolder brown primary wire from fuseholder and resolder it to terminal of standoff insulator.

5. Replace existing 2½-amp fuse with 1½-amp 3AGC fuse, Part No. 451-1002.

6. Replace back plate removed in step 1.

7. On Model 16, convert other amplifier module by repeating steps 1 thru 6.

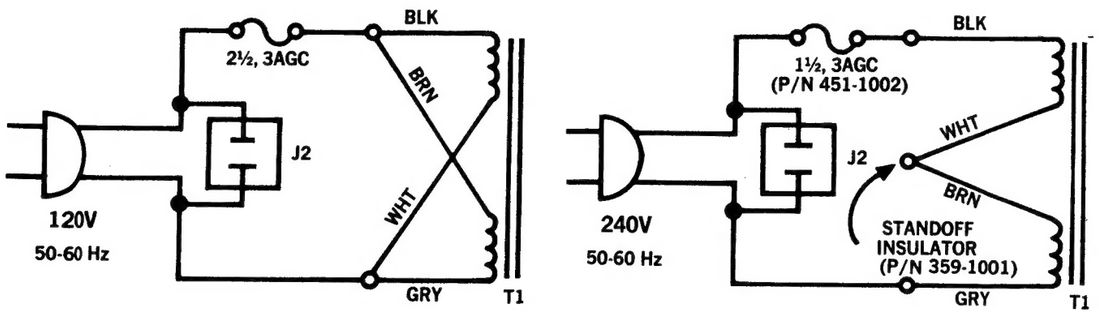


Figure 6. 240-Volt Conversion Diagram.

TECHNICAL SPECIFICATIONS

Input Signal for Rated Power Output ..... 1 volt rms
Input Impedance ..... 47,000 ohms
Frequency Response (20 Hz to 20 kHz) ..... minus 0.5 dB
(at 60 kHz) ..... no more than 2 dB
Damping Factor ..... better than 150 with 8-ohm load
Total Broadband Noise (shorted input) ..... Better than 90 dB below 80 watts into 8 ohms
Power Output, 20 Hz to 20 kHz (each channel)

LOAD	RMS POWER	IHF (Music Power)
4 ohms	80 watts	120 watts
8 ohms	80 watts	120 watts
16 ohms	50 watts	75 watts

Overload Permitted ..... No limit (automatically clips any signal exceeding about 90 watts rms)
Overload Recovery ..... Instantaneous
Total Harmonic Distortion (THD) (8-ohm resistive load) ..... Less than 0.1% typically less than 0.01%
Total Intermodulation Distortion (IM) (8-ohm load) ..... Less than 0.1% at rated outputs for any combination of two frequencies

Operating (Primary) Power Requirements*

NOMINAL VOLTAGE	RANGE	POWER	FREQUENCY	FUSE
120 vac	105 to 125 vac	240 watts	50/60 Hz	2.5A
240 vac	210 to 250 vac	240 watts	50/60 Hz	1.5A

Dimensions (Model 16) ..... 15⅜ inches wide 5¾ inches high 8 inches deep
(Model 16M) ..... 7⅛ inches wide 5¾ inches high 8 inches deep
Weight (as shipped) ..... Model 16 — 35 lbs.; Model 16M — 17 lbs.
*Split primary windings permit conversion to 240-volt operation.

Table 1. Technical Specifications. (All specifications subject to change without notice.)

REMOVAL, DISASSEMBLY, CLEANING

REMOVAL To remove the amplifier from its installation, proceed as follows:

1. Turn unit off, and unplug primary power cord from its source.

2. Tag and identify preamplifier output cables connected to amplifier INPUT jacks.

3. Remove unit from either front (steps 4 and 5) or back (steps 6 and 7), as applicable.

4. Remove four Phillips-head screws from corners of front panel.

5. Being careful not to scratch woodwork, withdraw amplifier from front.

6. Using a protective cover over the gold-anodized hex-head panel-mounting screws and using a wrench that will not mar the finish, first remove two screws from the bottom and then remove the two top screws.

7. Withdraw amplifier straight backward.

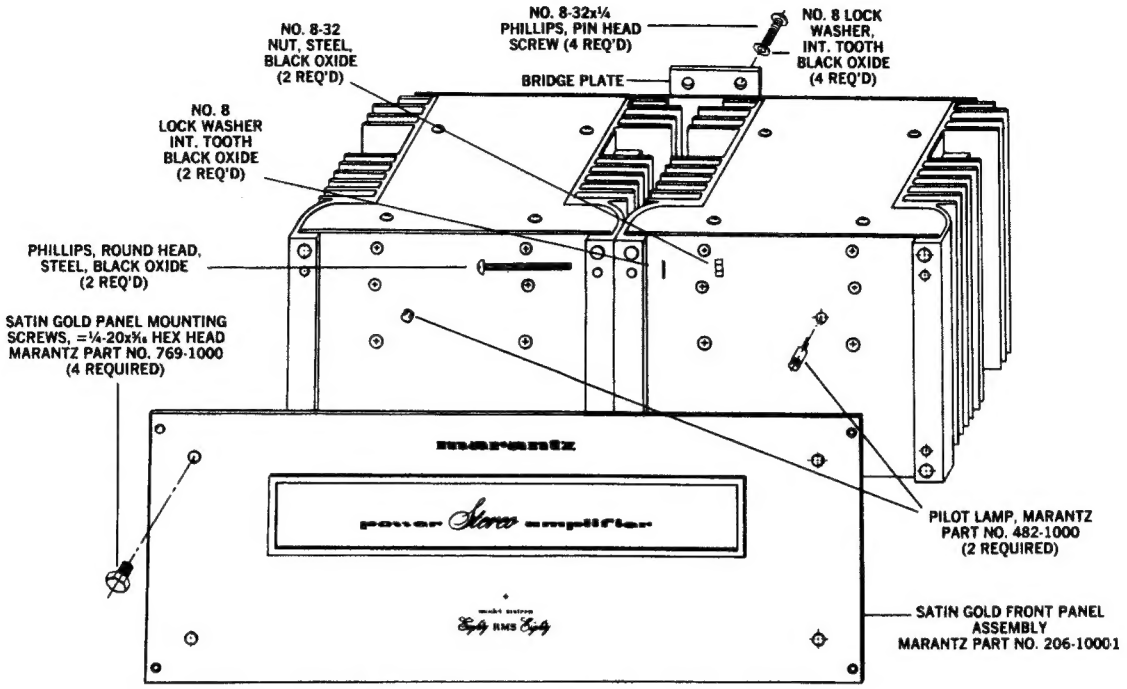


Figure 7. Removal of Front Panel and Separation of Modules.

DISASSEMBLY Disassemble the amplifier as follows:

CAUTION: The Model 16 and Model 16M contain voltages that, under certain circumstances, could be dangerous to personnel. Before doing any work on the amplifier, be sure all power is removed.

1. Disconnect amplifier from primary power source.
2. Remove amplifier from installation.
3. Using a 10-ohm 1-watt resistor having insulated leads, discharge power supply filter capacitors.
4. Disassemble amplifier as shown in Figure 7, and disassemble amplifier module as shown in Figure 11.

CLEANING The amplifier may be cleaned as follows:

NOTE: Cleaning is more quickly and thoroughly performed if the front panel assembly is removed, the left and right modules separated, the top and bottom covers removed, and the right and left transistor covers removed.

CAUTION: Use care to avoid scratching, burring, or chipping of the finish on mounting hardware, front panel, and chassis parts.

1. Using a brush attachment on a vacuum cleaner, vacuum out interior and exterior of amplifier, amplifier modules, covers, and panels. Dry compressed air may be used to dislodge dirt and debris.
2. Clean front panel assembly, covers, and amplifier modules with a non-abrasive, non-caustic cleaning solution. Use pipe cleaners, a soft brush, and lint-free cloths for cleaning and drying.
3. Remove dirt or corrosion from signal and ground contacts of INPUT jack. Use contact cleaner, or a non-metallic cleaning pad.
4. Touch up any chipped paint or anodizing on covers, heatsinks, or mounting hardware. (Use Continental Paint Co. #SP-Y-779 Semi-Gloss Black, or equivalent.)
5. After cleaning the unit, inspect for loose hardware, broken or shorted wires, cracked or charred parts, and broken or lifted printed circuit paths.

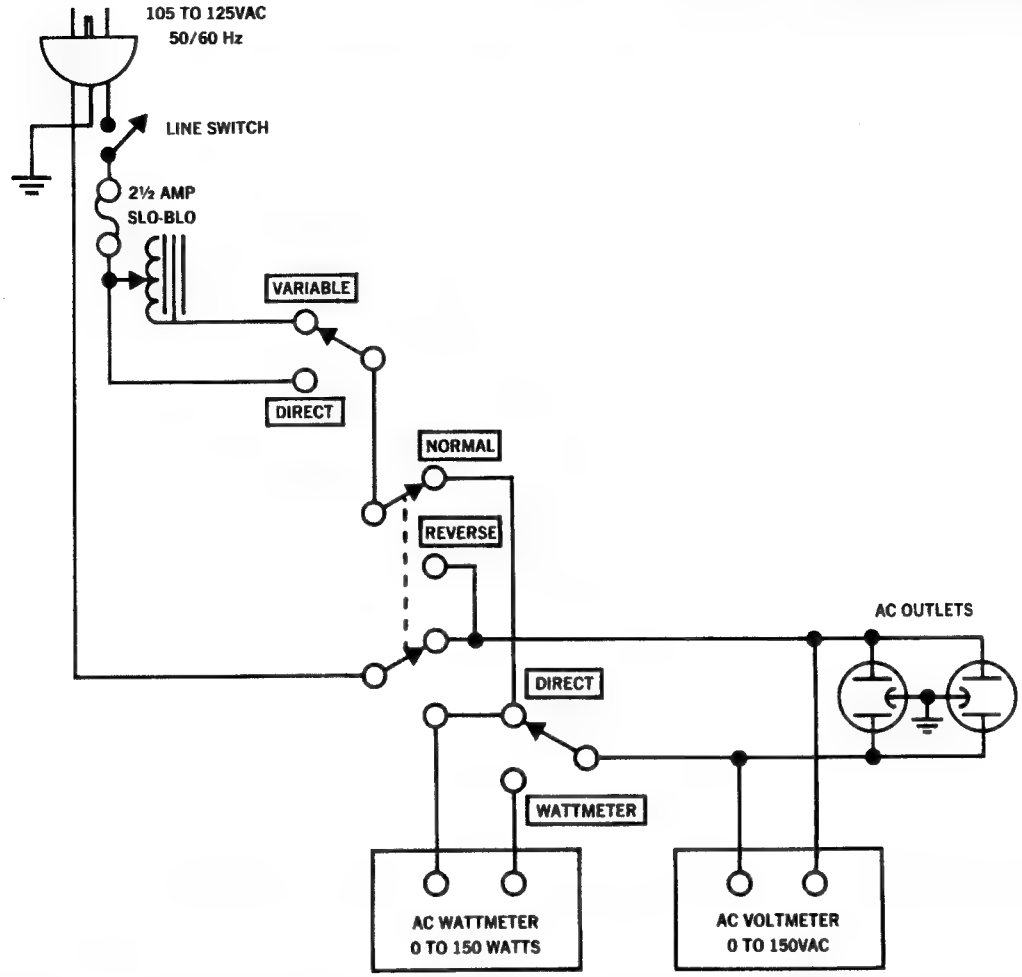
TEST EQUIPMENT REQUIRED FOR SERVICING

Table 2 lists the test equipment required for servicing the Model 16 and Model 16M solid state amplifiers. The wattmeter, ac voltmeter, and variac may be assembled as a test fixture as shown schematically in Figure 8, and the load resistors and ac ammeter may be assembled into a second test fixture as shown in Figure 9.

Item	Manufacturer and Model No. (or equivalent)	Use
Distortion Analyzer	Hewlett Packard, Model 331A or 333A	Measures distortion and voltage of amplifier output.
Audio Oscillator	Weston Model CVO-100P (NOTE: Less than 0.02 percent residual distortion is required.)	Sinewave and squarewave signal source.
Oscilloscope	Tektronix, Model 503; Data, Model 555	Waveform analysis and troubleshooting
VTVM	RCA Senior Volt-Ohmyst, Model WV-98C	Voltage and resistance measurements.
AC Wattmeter	Simpson, Model 390	Monitors primary power consumption of amplifier.
AC Ammeter (0 to 10 amps)	Commercial Grade	Monitors amplifier output under short circuit condition.
Line Voltmeter (0 to 150 vac)	Commercial Grade	Monitors potential of primary power to amplifier.
Variable Autotransformer (0 to 140 vac, 10 amps)	Powerstat, Model 116B	Adjusts level of primary power to amplifier.
Shorting Plug	Use phono plug with 600 ohms across center pin and shell.	Shorts amplifier input to eliminate noise pickup.
Power Supply Bleeder Resistor (10 ohms at 1 W)	Commercial Grade	Discharges power supply filter capacitors prior to disassembly or resistance measurements.
Output Load Resistor (8 ±0.5%, 250 W)	Commercial Grade	Provides 8-ohm load for amplifier output termination.
Output Load Resistor (4 ±0.5%, 250 W)	Commercial Grade	Provides 4-ohm load for amplifier output termination.
Output Load Capacitor (0.5 mfd)	Mylar	Provides capacitive load for instability checks.
AC Power Control Box	Optional Item. Fabricate in accordance with Figure 9.	Monitors and controls primary power for amplifier.
Amplifier Output Load Box	Optional Item. Fabricate in accordance with Figure 10.	Provides various amplifier loads and can monitor shorted output.

Table 2. Test Equipment Required for Servicing.

Figure 8. AC Power Control Box, Schematic Diagram.



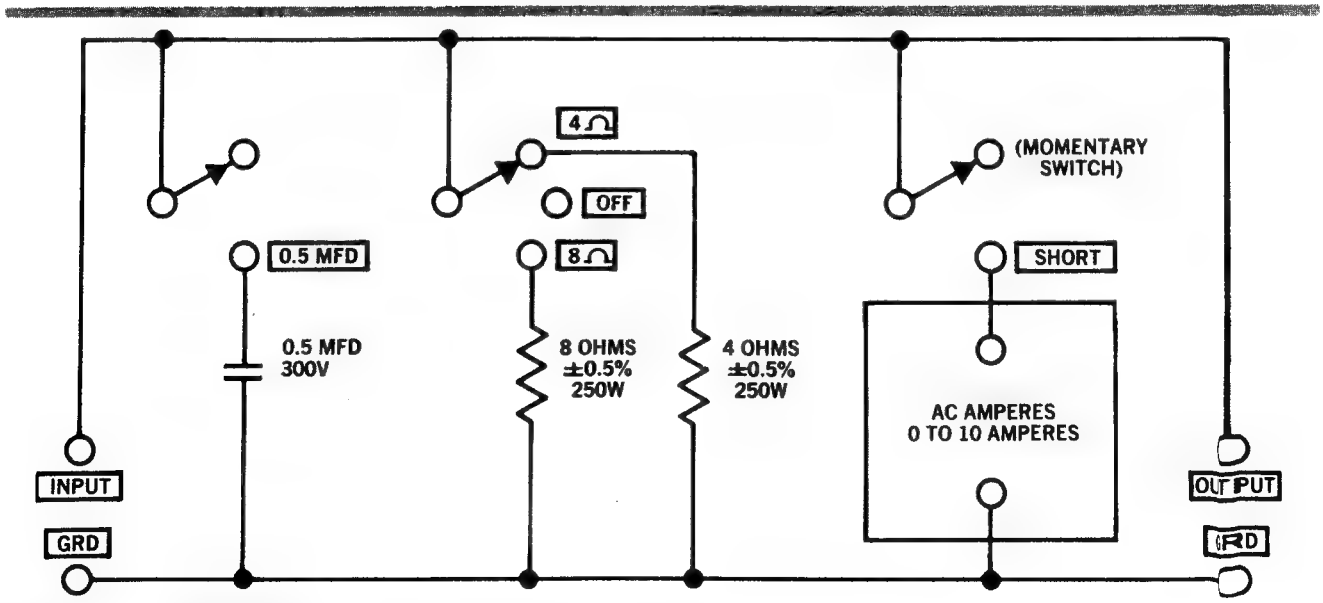


Figure 9. Amplifier Output Load Box, Schematic Diagram.

PERFORMANCE VERIFICATION TEST PROCEDURE

A. TEST EQUIPMENT.
Refer to Table 2 for required test equipment.

B. PRELIMINARY PROCEDURES.

1. Make the test set-up shown in Figure 10 with the instrument controls set in the following positions:

LINE SWITCH	OFF
VARIABLE — LINE SWITCH	VARIABLE
WATTMETER SWITCH	ON
VARIAC	0 (fully C.C.W.)
D.C. BALANCE METER	OFF
LOAD	4 OHMS (0.5 MFD OFF)
AUDIO GENERATOR	
Frequency	2 kHz
Output	5 V RANGE
Gain	MINIMUM
A.C. VOLTMETER	30 V RANGE

2. If a Model 16 amplifier is to be tested, disconnect the interconnecting power cord between modules and test one module at a time.
3. Make sure the connections between the resistive load and the LOUDSPEAKER terminals of the amplifier module have negligible resistance compared with the resistance of the load itself. Appreciable resistance in wiring adds to the total load, resulting in inaccurate measurement of output power.
4. Connect amplifier output to load, and connect the ac cord to line power. Connect a shorting plug (600 ohms) into the INPUT jack of the amplifier.
5. Using a long insulated screwdriver, pre-set the BIAS ADJ. potentiometer R20 (lower hole on rear plate of amplifier) fully counter-clockwise.

C. BIAS ADJUSTMENT TEST.

1. Turn line switch on (Figure 8), and slowly advance variac while observing the voltmeter and wattmeter. When line voltage reaches approximately 105 volts, the amplifier should turn on, and line wattmeter should indicate between 14 and 16 watts. If wattmeter indicates either zero or greater than 100 watts, a defect exists. Turn off variac and refer to the Trouble Analysis section of this manual.
2. Advance the variac until voltmeter indicates 120 volts. Adjust bias potentiometer R20 until wattmeter indicates between 34 and 36 watts.

   NOTE: AC line voltage must be maintained at 120 volts at all times during remaining testing.

D. DC BALANCE TEST.

1. With an oscilloscope connected as shown in Figure 10, set the oscilloscope in the DC amplification position and select the greatest gain position.
2. Turn the amplifier on, and adjust potentiometer R8 (upper hole on rear plate) for an indication of zero volts (±10 millivolts) as displayed on the screen of the oscilloscope.

E. TOTAL HUM AND NOISE TEST.

1. With the 600-ohm shorting plug connected to the INPUT jack and a 4-ohm resistive load connected across the LOUDSPEAKER terminals, connect a distortion analyzer across the load.

   NOTE: In this test and tests that follow, if distortion analyzer used does not contain a built-in voltmeter a VTVM may be substituted.

2. Set the distortion analyzer controls for voltage measurement and apply power to the amplifier.
3. If the distortion analyzer indicates more than one millivolt, refer to the Trouble Analysis section of this manual.

F. MAXIMUM POWER OUTPUT.

1. Remove the shorting plug and connect the audio oscillator to the amplifier input. Set audio oscillator frequency to 2 kHz.
2. With the distortion analyzer connected across the output load (4-ohms), set the analyzer on the 30-volt ac scale.
3. Turn the amplifier on, and increase the audio oscillator output just below the clipping point of the amplifier as observed on the oscilloscope.
4. Verify that the analyzer indicates between 17.9 volts and 21.5 volts ac.
5. Check for symmetrical clipping of both top and bottom of the waveform by verifying the voltage difference between positive and negative clipping level is no more than one volt.
6. Repeat step 3, changing the audio oscillator frequency first to 20 Hz and then to 20 kHz. Output should be between 17.9 volts and 21.5 volts, as in step 4.

G. HARMONIC DISTORTION TEST.

1. Using the same test set-up as in Paragraph **F**, switch to an 8-ohm load and set the frequency of the audio oscillator and the distortion analyzer to 20 kHz.
2. Set the controls of the analyzer for voltage measurement on the 30-volt scale.
3. Adjust the audio oscillator output level until the analyzer meter indicates 25.3 volts.
4. Switch the distortion analyzer to SET LEVEL-MANUAL mode, and adjust SENSITIVITY for full scale reading on 0-1 scale.
5. Measure the total harmonic distortion with the analyzer and verify it is less than 0.1 percent.

   NOTE: Any parasitic oscillation in the amplifier will be displayed on the oscilloscope when capacitance is switched into the load.

Table 3. Performance Verification Test Procedure.

6. Switch 0.5 MFD across the load (Figure 9) and verify distortion is no greater than 0.2 percent. Switch 0.5 MFD out of the load.
7. Switch the distortion analyzer back to SET LEVEL-MANUAL. (Do not adjust SENSITIVITY of analyzer.)
8. Change the frequency of the audio oscillator and distortion analyzer to 2 kHz. Adjust audio oscillator output as necessary to have a full scale reading on the 0-1 scale on the analyzer.
9. Measure the distortion, verifying it is no greater than 0.02 percent.
10. Repeat steps 8 and 9, changing frequency to 20 Hz. Distortion should be no more than 0.03 percent.
11. Switch 0.5 MFD across the load and verify distortion is no more than 0.03 percent.
12. Check for parasitic oscillations; there should be none.

H. SHORT CIRCUIT TEST.

1. Switch back to a 4-ohm load and set the audio oscillator to 400 Hz. Adjust output level of oscillator just below clipping of the output wave as displayed on the oscilloscope.

   CAUTION: Do not perform short circuit test if amplifier shows any sign of parasitic oscillation.

2. Press the momentary switch (Figure 9) to a short circuit condition for no longer than three seconds. Verify the ac ammeter indicates no more than 6.5 amperes.

I. OUTPUT RELAY TEST.

1. Switch to an 8-ohm load and connect distortion analyzer across amplifier output load. Connect audio oscillator to amplifier INPUT jack.
2. Set analyzer to 30-volt range. Set frequency of audio oscillator to 10 Hz, and adjust oscillator output for a 25.3 volt reading on the analyzer.
3. Verify that relay opens up the output of the amplifier within two seconds maximum.

   NOTE: The frequency of the audio oscillator may require varying (in increments of 1 Hz) down to 5 Hz for the relay to open.

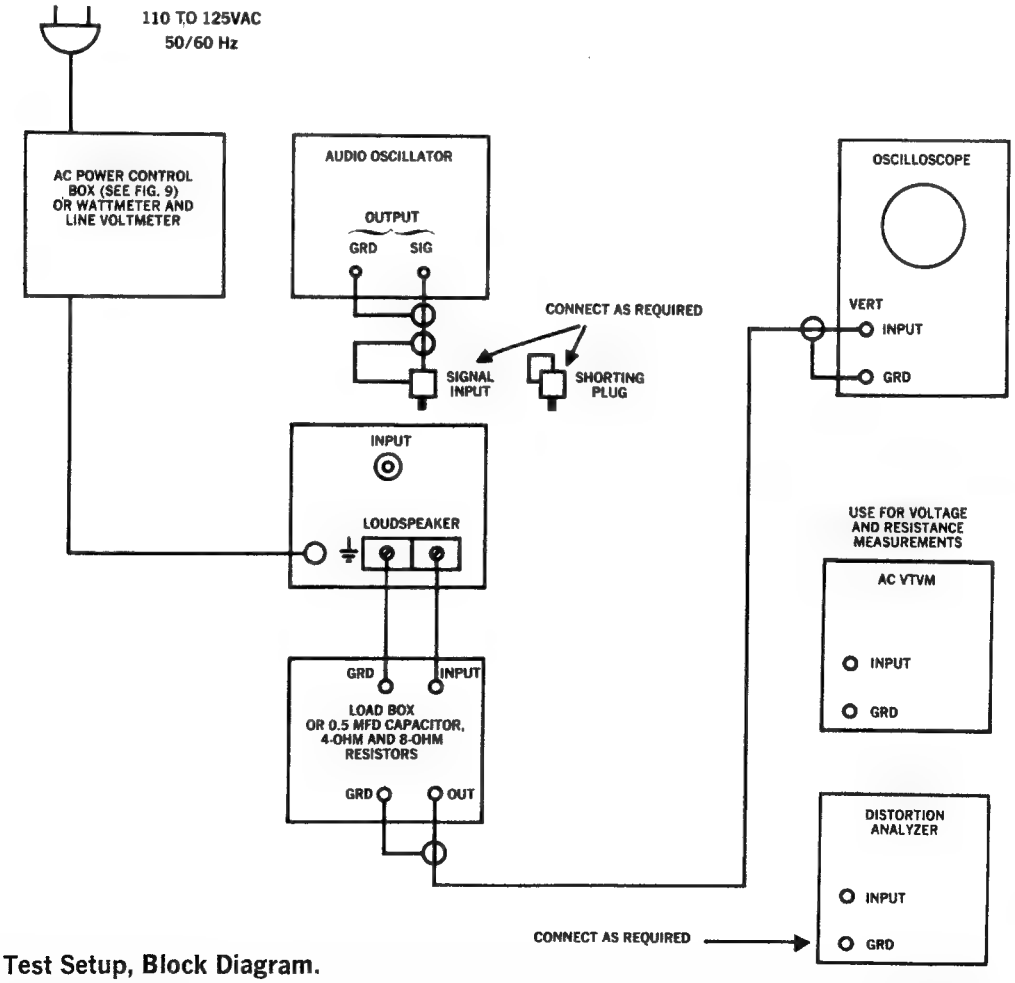


Figure 10. Test Setup, Block Diagram.

TROUBLE ANALYSIS PROCEDURE

The trouble analysis procedure that follows contains typical trouble symptoms and their remedies. Other field problems will be covered through service bulletins (supplementary to this manual) which will be issued to all stations. The schematic diagram (Figure 14) contains a Voltage Chart that lists typical voltages taken at various test points in a properly-operating amplifier.

NOTE: Performance Verification is necessary following any repair.

SYMPTOM	PROCEDURE
1. Excessive line consumption (100 watt or more).	a. Check for shorted rectifiers CR6 through CR9; also check C13, C14. b. Check for shorted transistors Q6 through Q11, or check Q5. Check for open control R20, and bias diode CR5. Check T1 for short.

CAUTION: Because the driver and output stages are direct coupled, components may fail as a direct result of an initial component failure. If a shorted transistor or Zener diode is found, or control or bias diode, be sure to check the remaining driver and output components for short or open circuits before re-energizing the amplifier. After replacement of any of these components, increase the Variac voltage slowly while monitoring the wattmeter as described in paragraph C of Performance Verification.

2. No line consumption or zero bias.	a. Check line cord, fuse, transistors Q5, Q8 through Q14, bias diode CR5. b. Check for open rectifiers CR6 through CR9, or open T1.
3. High d-c voltage at loudspeaker terminals before time delay circuit is deactivated.	a. Check transistors Q12, Q13, Q14 for leakage.
4. High d-c voltage at loudspeaker terminals at all times.	a. Check CR3 or CR4 for open or shorts.
5. No D-C Balance.	a. Check A1 (op amp) and Zener diodes CR1 and CR2. b. Check R7, R8, and R9.
6. High hum and noise level.	a. Check filter capacitors C5, C6, C13, C14.
7. Parasitic Oscillation.	a. Check for defective C9, C16, C17.
8. Improper Clipping.	a. Check resistors R28, R29. (Resistance may be varied by unsoldering leads and sliding leads in and out of board, as required.) b. Check transistors Q1 and Q2.

Table 4. Trouble Analysis Procedure.

PARTS LIST

Reference Designator	Description	Marantz Part Number
A1	Operational (IC) Amplifier	466-1005
A2	Amplifier Board Assembly	200-1005-1
A3	PNP Power Board	200-1001-1
A4	Bias Board	200-1003-1
A5	NPN Power Board	200-1000-1
A6	Rectifier/Relay Board	200-1004-1
C1	Capacitor, Mylar, 1 MFD, 200 VDC	388-1000
C2	Capacitor, Mica, 100 PFD, 500 VDC	385-1001
C3	Capacitor, Electrolytic, 125 MFD 16 VDC +10% −50%	381-1005
C4	Capacitor, Polyester, 0.22 MFD, 250 VDC	386-1001
C5	Capacitor, Electrolytic, 10 MFD, 25 VDC	381-1000
C6	Same as C5	381-1000
C7	Capacitor, Polyester, 0.1 MFD, 250 VDC	386-1000
C8	Same as C7	386-1000
C9	Capacitor, Mica, 150 PFD, 10%, 500 VDC	385-1002
C10	Capacitor, Electrolytic, 16 MFD, 10 VDC +10% −50%	381-1004
C11	Capacitor, Mica, 47 PFD, 500 VDC	385-1000
C12	Capacitor, Mica, 27 PFD, 500 VDC	385-1005
C13	Capacitor, Electrolytic, 5000 MFD, 50 VDC	381-1003
C14	Same as C13	381-1003
C15	Capacitor, Polyester, 0.22 MFD, 250 VDC	386-1002
C17	Capacitor, Mica, ≅ 300 PFD, 10%, 500 VDC	Selected at test
C18	Capacitor, Mica, 270 PFD, 500 VDC	385-1006
C19	Capacitor, Electrolytic, 100 MFD, 6.4 VDC	381-1006
C20	Same as C19	381-1006
C21	Capacitor, Mica, 150 PFD, 10%, 500 VDC	385-1002
CR1	Diode, Zener (SZ51064K)	459-1000
CR2	Same as CR1	459-1000
CR3	Diode, Rectifier (furnished with MTG kit comprised of the following:	460-1003
	Lug, Solder	365-2000
	Washer, Insulating, Mica	371-1002
	Bushing, Stud Insulating	371-1003
	Washer, Flat #10	675-1000
	Lockwasher, #10, Internal Tooth	675-1001
	Nut, Hex, #10-32	689-1000
CR4	Diode, Rectifier (furnished with MTG kit)	460-1002
CR5	Diode, Rectifier (SZ51066K)	460-1004
CR6	Diode, Rectifier (SR154)	460-1000
CR7	Diode, Rectifier (SR154R)	460-1001
CR8	Same as CR6	460-1000
CR9	Same as CR7	460-1001
DS1	Lamp	482-1000
F1	Fuse, 2.5A AGC (120 volt operation)	451-1000
F2	Fuse, 1.5A 3AG3 (240 volt operation)	
J1	Jack, Input (includes MTG HDWE)	360-1000
J2	Outlet, Auxiliary AC	360-1001
P1	Linecord, 12″ LG	361-1000
P1	Linecord, 72″ LG	361-1001
Q1	Transistor, PNP SW (SPS400)	461-1000
Q2	Transistor, NPN SW (SPS439)	462-1000
Q3	Transistor, PNP GP (SS9306)	461-1003
Q4	Transistor, NPN GP (SS9305)	462-1004
Q5	Transistor, NPN GP (SPS441)	462-1001
Q6	Transistor, NPN PWR (SJ3680)	462-1003
Q7	Transistor, PNP PWR (SJ3681)	461-1002
Q8	Transistor, PNP PWR(SJ3679)	461-1001
Q9	Transistor, NPN PWR (SJ3678)	462-1002
Q10	Same as Q8	461-1001
Q11	Same as Q9	462-1002
Q12	Transistor, NPN GP (SS47)	462-1007
Q13	Transistor, NPN SW (SPS439)	462-1000
Q14	Same as Q13	462-1000
R1	Resistor, Carbon Comp., ½ W, 470 K, 5%	422-6472
R2	Resistor, Carbon Comp., ½ W, 47 K, 5%	422-5472

PARTS LIST (CONT'D.)

Reference Designator	Description	Marantz Part Number
R3	Resistor, Film, ½ W, 820 ohm, 2%	432-3821
R4	Resistor, Carbon Comp., ½ W, 1 K, 5%	422-4102
R5	Resistor, Film, ½ W, 20 K, 2%	432-5201
R6	Resistor, Film, ½ W, 100 K, 2%	432-6101
R7	Resistor, Film, ½ W, 4.7 K, 2%	432-4471
R8	Resistor, Variable, 2 K, 10%, W/W	420-1000
R9	Same as R7	432-4471
R10	Resistor, Carbon Comp., 1 W, 2 K, 5%	423-4202
R11	Resistor, Film, ½ W, 560 ohm, 2%	432-3561
R12	Resistor, Carbon Comp., ½ W, 300 ohm, 10%	422-3303
R13	Resistor, Film, ½ W, 15 K, 2%	432-5151
R14	Same as R13	432-5152
R15	Same as R11	432-3561
R16	Resistor, Carbon Comp., ½ W, 56 ohm, 5%	422-2562
R17	Same as R16	422-2562
R18	Resistor, Carbon Comp., ½ W, 47 ohm, 10%	422-2473
R19	Same as R2	422-5472
R20	Resistor, Variable, 1K, 10%, W/W	420-1001
R21	Same as R18	422-2473
R22	Same as R10	423-4202
R23	Resistor, Carbon Comp., 1 W, 100 ohm, 10%	423-3103
R24	Resistor, Carbon Comp., 1 W, 100 ohm, 10%	423-3103
R25	Resistor, Carbon Comp., ½ W, 5.6 K, 10%	422-4563
R26	Resistor, BWH, 2 W, 0.15 ohm, 10%	436-0153
R27	Same as R26	436-0153
R28	Resistor, W/W, 5 W, 0.085 to 0.09 ohms	145-1000
R29	Same as R28	145-1000
R30	Same as R26	436-0153
R31	Same as R26	436-0153
R32	Resistor, Carbon Comp., 2 W, 2.2 K, 10%	424-4223
R33	Resistor, Carbon Comp., 1 W, 2.7 ohm, 10%	423-1273
R34		428-3822
R35	Resistor, W/W, 820 ohm, 5%	422-4102
R36	Resistor, Carbon Comp., ½ W, 1 K, 5%	436-1123
R37	Resistor, BWH, 2 W, 1.2 ohm, 10%	436-3393
R38	Resistor, BWH, 2 W, 390 hom, 10%	422-6823
R39	Resistor, Carbon Comp., ½ W, 820 K, 10%	422-5333
R40	Resistor, Carbon Comp., ½ W, 33 K, 10%	422-6273
R41	Resistor, Carbon Comp., ½ W, 270 K, 10%	422-5473
R42	Resistor, Carbon Comp., ½ W, 47 K, 10%	422-4333
R43	Resistor, Carbon Comp., ½ W, 3.3 K, 10%	432-5101
R44	Resistor, Film, ½ W, 10 K, 2%	440-1000
T1	Transformer, Power	363-1000
TB1	Block, Barrier	201-1000-1
TB2	Terminal Board Assembly	362-1000
TB3	Terminal Strip	481-1000
XDS1	Socket, Lamp (includes MTG HDWE)	367-1000
XF1	Holder, Fuse (includes MTG HDWE)	368-1001
XQ6	Socket, Transistor	368-1001
XQ7	Same as XQ6	368-1000
XQ8	Socket, Transistor	368-1000
XQ9	Socket, Transistor	368-1000
XQ10	Same as XQ8	368-1000
XQ11	Same as XQ9	
	FRONT PANEL ASSEMBLY, consisting of:	206-1000-1
	Painted Panel	134-1000-1
	Panel MTG Screws, Satin Gold, #¼-20 x 5/16 Head	769-1000
	Window	170-1001-1
	Painted light deflector lens	170-1001-1
	Bezel	172-1000
	BRIDGE PLATE, consisting of:	137-1000
	Screw, Phillips, Pan Hd, Stl, Blk Oxide, #8-32 x ¼	751-0412
	Lockwasher, Int Tooth, #8, Stl, Blk Oxide	677-5512

Table 5. Parts List.

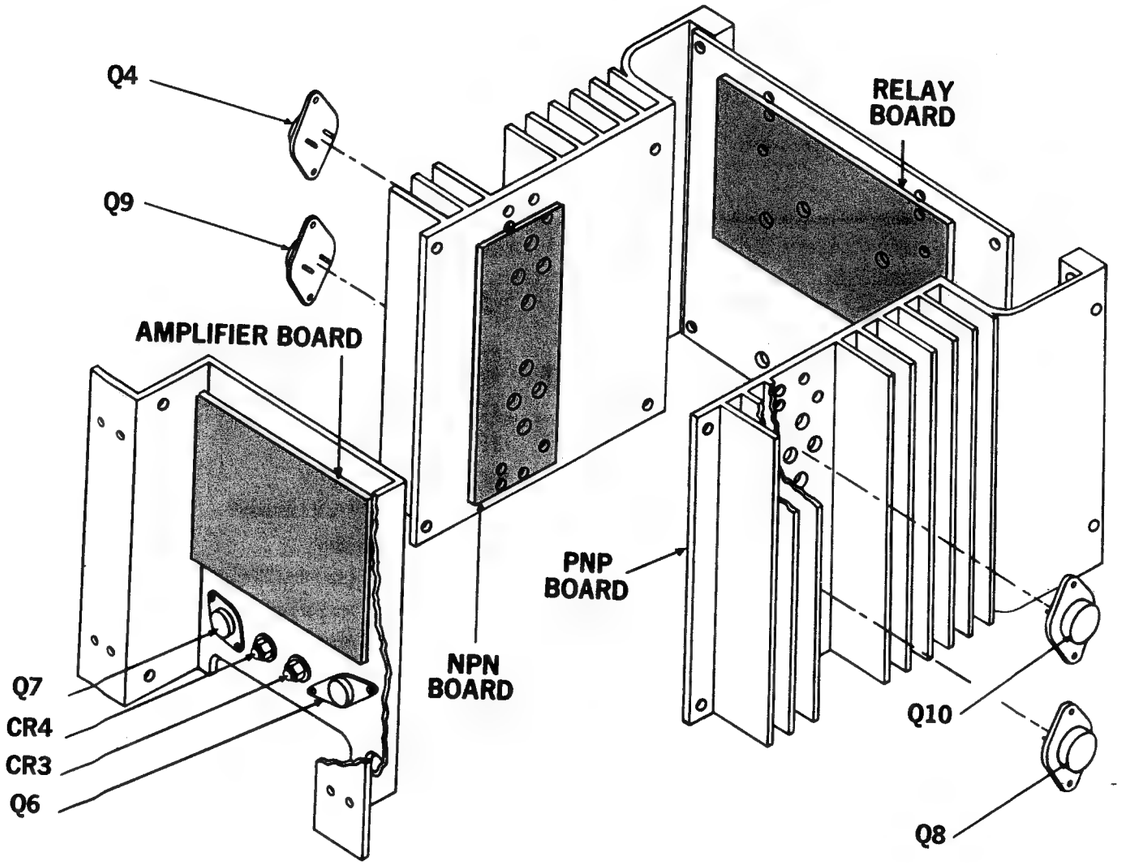


Figure 11. Amplifier Module, Exploded View.

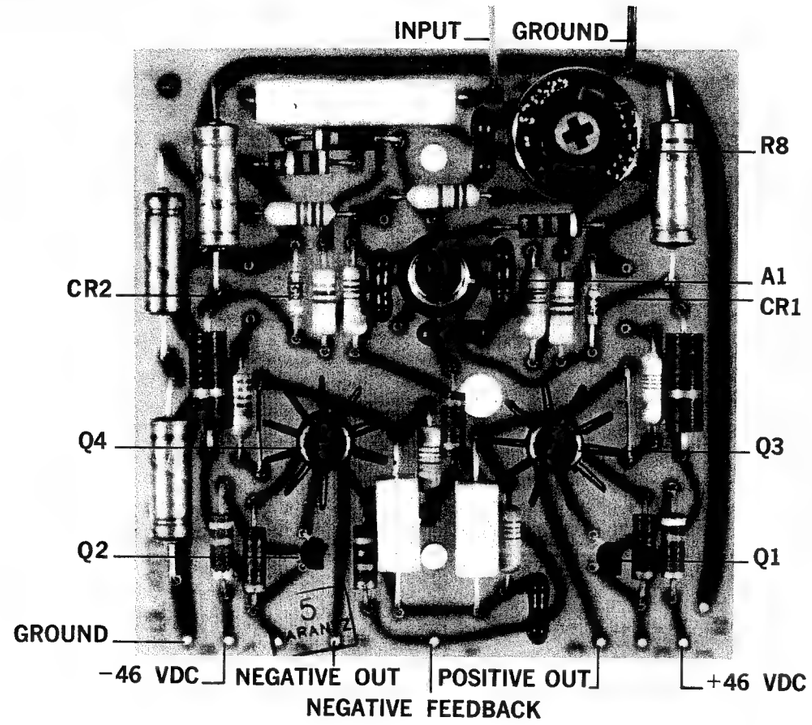


Figure 12. Amplifier Circuit Board.

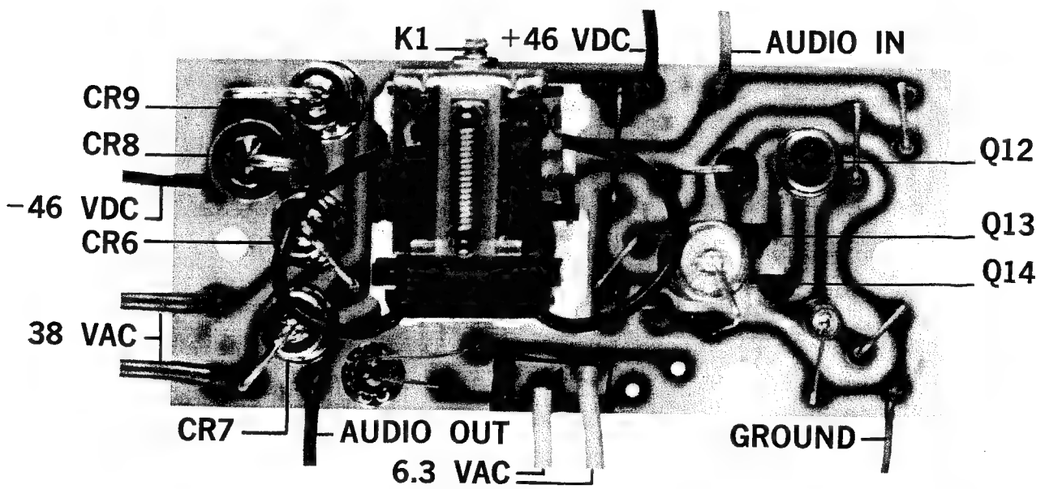


Figure 13. Relay Board.

VOLTAGE CHART

TEST POINT	BASE (V)	EMITTER (V)	COLLECTOR (V)
Q1	−.019 to B+	+46 to Gnd	−1.7 to B+
Q2	−.019 to B−	−46 to Gnd	+1.7 to B−
Q3	−1.7 to B+	−1.2 to B+	+1.25 to Gnd
Q4	+1.7 to B−	+1.2 to B−	−1.25 to Gnd
Q5	−.55 to Gnd	−1.25 to Gnd	+1.25 to Gnd
Q6	−.6 to B+	+.7 to Gnd	−.6 to B+
Q7	+.6 to B−	−.7 to Gnd	+.6 to B−
Q8	−.6 to B+	−.031 to B+	−47 to B−
Q9	+.6 to B−	+.031 to B−	+47 to B−
Q10	−.6 to B+	−.031 to B+	−47 to B+
Q11	+.6 to B−	+.031 to B−	+47 to B−
Q12	+.6V to Gnd	Gnd	+.76 to Gnd
Q13	+1.2 to Gnd	+.6V to Gnd	+.76 to Gnd
Q14	+.008 to Gnd	0 to Gnd	+1.2 to Gnd
B+	+46 to Gnd		
B−	−46 to Gnd		

NOTES AND CONDITIONS:

1. All DC voltages ±10%.
2. All voltages measured using a VTVM.
3. All voltages measured while maintaining a 120-volt input.
4. Idle power consumption 35 ±2 watts.
5. All voltages measured with input jack shorted.
6. B+ and B− measured with respect to ground bus.

SCHEMATIC AMPLIFIER-80 WATTS MODEL 16 (OPPOSITE PAGE)

NOTES:

1. ALL RESISTOR VALUES ARE IN OHMS AND ARE ½ W.
2. CAPACITOR VALUES EXPRESSED DECIMALLY ARE IN MICRO-FARADS OTHERS ARE IN PICO-FARADS.
3. F DENOTES PRECISION FILM RESISTORS.
4. LAST REFERENCE DESIGNATION USED: A1, C21, CR9, DS1, F1, J2, K1, L1, Q14, R44, T1, TB1.
5. REF. DESIGNATORS NOT USED: R34.
6. VALUE OF C17 SELECTED IN TEST.
7. DENOTES A CHANGE IN SOME S/N1; SEE CHANGE RECORD.

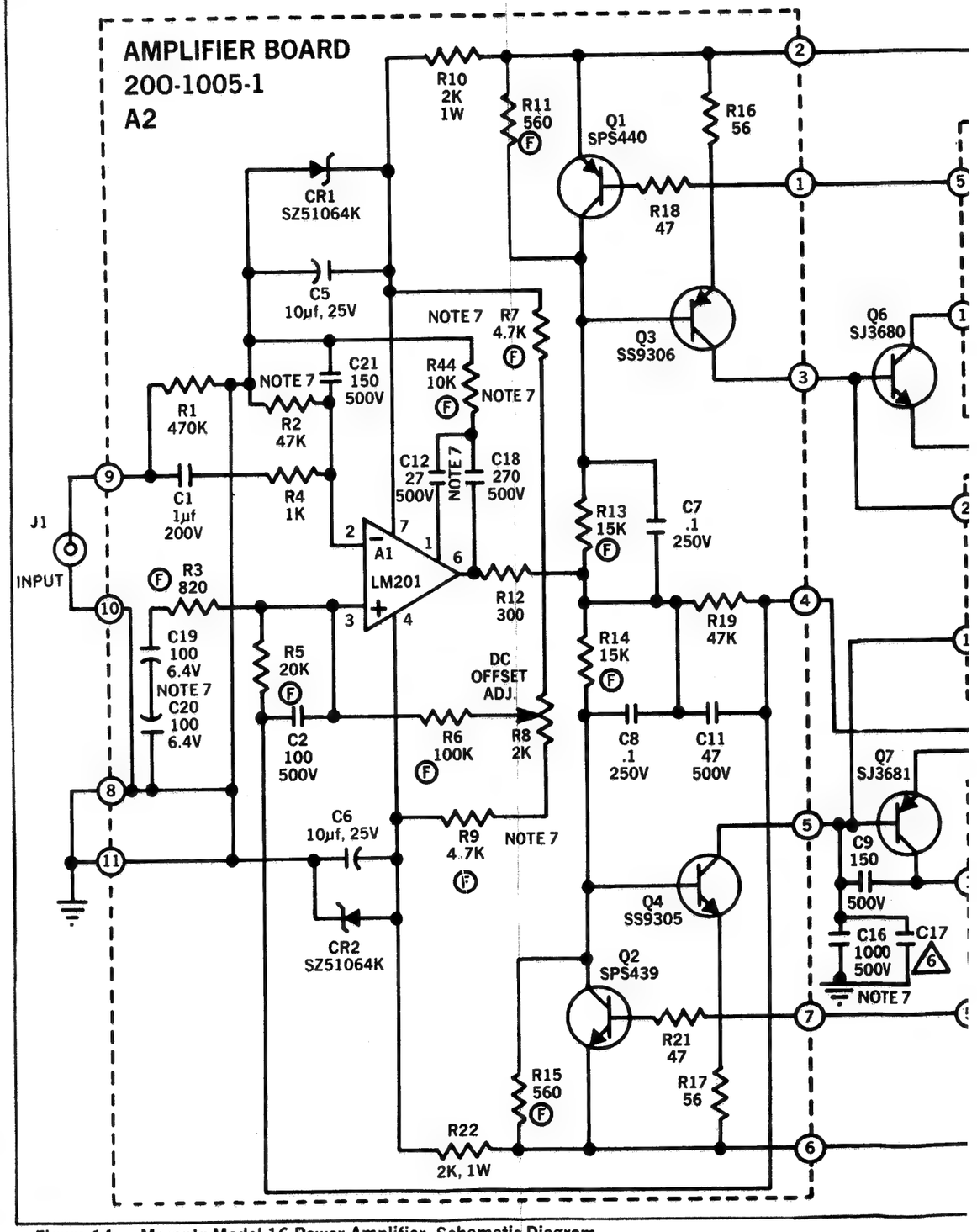
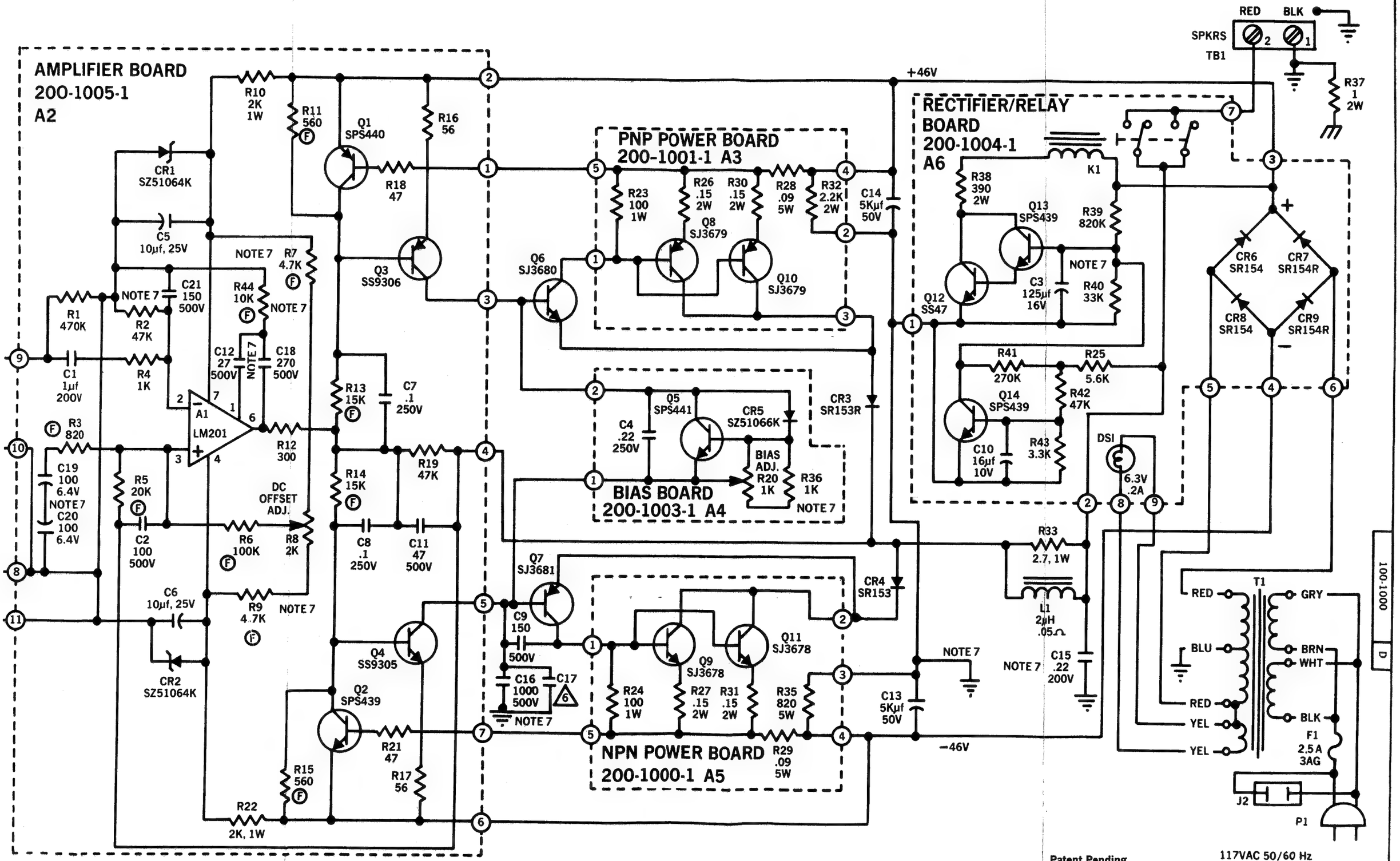


Figure 14. Marantz Model 16 Power Amplifier, Schematic Diagram.



14. Marantz Model 16 Power Amplifier, Schematic Diagram.

Addendum for Model 16 (100 RMS 100)

This manual is the same as the Model 16 80 RMS 80 manual except for the following:

Page 4 — Paragraph following AMPLIFIER PROTECTION, change references (2) to 100 watts to 115 watts.

either 120 vac or 240 vac (Figure 6). A fuse in a bayonet-type holder provides protection to the primary winding. One secondary winding supplies 6.3 volts for the pilot lamps. The other secondary winding delivers power to a fullwave bridge rectifier CR6, with the center tap circuit grounded (not chassis grounded). Since neither side of the bridge is grounded, the 90 to 100 volts of dc output appears as +45 to +50 volts and −45 to −50 volts, as referenced to circuit ground. Plus and minus outputs are each filtered with 5,000 microfarad capacitors C13 and C14. The filtered outputs are applied directly to all but the operational amplifier circuit, which receives plus and minus 15 volts from voltage dividers connected between ground and the 46-volt source. R10 and Zener diode CR1 provide a regulated output of +15 volts; R22 and Zener diode CR2 provide a regulated output of −15 volts. C5 and C6 filter the 15-volt source.

LOUDSPEAKER PROTECTION. Contacts of relay K1 connect the output of the amplifier to the LOUDSPEAKER terminal. Positive power supply voltage is applied to R39 and to one side of K1 coil through diodes CR7 and CR8, with the ground return of K1 coil being through R38 and relay-driver Q12. When voltage is applied through R39 to the base of Q13, base voltage rises slowly as determined by the time constant of R40 and C3. Normally, in about ten seconds, the level of positive voltage at the base of Q13 is sufficiently great to cause relay K1 to energize.

If an output fault should occur, K1 will remain de-energized during the normal time delay recycle (which happens only when the output returns to normal). If the faulty power output signal persists, as with an amplifier circuit failure, the output will remain disconnected from the loudspeakers. Relay K1 de-energizes immediately upon removal of AC power.

Page 8 — 5. Replace existing 3 amp fuse with 1½-amp, 3AGC fuse, Part No. 451-1002.
Figure 6. Change 2½, 3AGC with 3, 3AGC

Page 9 — Technical Specifications

Damping Factor . . . . . better than 100 with 8-ohm load

Total Broadband Noise (shorted input) . . . . . Better than 90 dB below 100 watts into 8 ohms

Power Output, 20 Hz to 20 kHz (each channel)

LOAD	RMS POWER	IHF (Music Power)
4 ohms	100 watts	150 watts
8 ohms	100 watts	150 watts
16 ohms	50 watts	75 watts

Overload Permitted . . . . . No limit (automatically clips any signal exceeding about 115 watts rms)

Operating (Primary) Power Requirements

NOMINAL VOLTAGE	RANGE	POWER	FREQUENCY	FUSE
120 VAC	105 to 125 VAC	300 watts	50/60 Hz	3 A
240 VAC	210 to 250 VAC	300 watts	50/60 Hz	1.5 A

Page 9 — Removal, Disassembly, Cleaning — paragraph 7.

7. Pull amplifier straight backward.

Page 13 — Maximum Power Output — paragraph F.

4. Verify that the analyzer indicates between 22 volts and 23.5 volts ac.

6. Repeat step 3, changing the audio oscillator frequency first to 20 Hz and then to 20 kHz. Output should be between 22 volts and 23.5 volts, as in step 4.

Page 13 — Harmonic Distortion Test — paragraph G.

3. Adjust the audio oscillator output level until the analyzer meter indicates 28.3 volts.

Page 14 — Short Circuit Test — paragraph H.

1. Switch back to a 4-ohm load and set the audio oscillator to 200 Hz. Adjust output level of oscillator just below clipping of the output wave as displayed on the oscilloscope.

2. Press the momentary switch (Figure 9) to a short circuit condition for no longer than three seconds. Verify the ac ammeter indicates no more than 7.0.

Page 14 — Output Relay Test — paragraph I.

2. Set analyzer to 30-volt range. Set frequency of audio oscillator to 10 Hz, and adjust oscillator output for a 28.3 volt reading on the analyzer.

Page 15 — Procedure

a. Check for shorted rectifiers CR6 through CR8; also check C13, C14.

PARTS LIST

Reference Designator	Description	Marantz Part Number
A1	Integrated Circuit	466-1005
A2	Assy, Comp., Ampl. Board	200-1005-3
A3	Assy, Comp., PNP Power Board	200-1011-1
A4	Assy, Comp., Bias Board	200-1003-1
A5	Assy, Comp., NPN Power	200-1012-1
A6	Assy, Comp., Rect/Relay Board	200-1013-1
C1	Capacitor, 1.0 MFD, 250 V	388-1000
C2	Capacitor, 100 PFD, 500 V	385-1001
C3	Capacitor, 125 MFD, 16 V	381-1005
C4	Capacitor, 0.22 MFD, 250 V	386-1001
C5	Capacitor, 10 MFD, 25 V	381-1000
C6	Capacitor, 10 MFD, 25 V	381-1000
C7	Capacitor, 0.1 MFD, 250 V	386-1000
C8	Capacitor, .022 MFD, 100 V	383-1001
C9	Capacitor, 150 PFD, 500 V	385-1002
C10	Capacitor, 16 MFD, 10 V	381-1004
C11	Capacitor, 47 PFD, 500 V	385-1000
C12	Capacitor, 27 PFD, 500 V	385-1005
C13	Capacitor, 5000 MFD, 50 V	381-1003
C14	Capacitor, 5000 MFD, 50 V	381-1003
C15	Capacitor, 0.22 MFD, 250 V	386-1002
C16	Capacitor, 1500 PFD, 500 V	385-1008
C17	Capacitor, ≅300 PFD, 500 V	385-
C18	Capacitor, 270 PFD, 500 V	385-1006
C19	Capacitor, 100 MFD, 6.4 V	381-1006
C20	Capacitor, 100 MFD, 6.4 V	381-1006
C21	Capacitor, 150 PFD, 500 V	385-1002
C22	Capacitor, 10 MFD, 64 V	381-1010
C23	Capacitor, 300 PFD, 500 V	385-1004
CR1	Diode, Zener	459-1000
CR2	Diode, Zener	459-1000
CR3	Diode, Rect. (with mtg kit)	460-1003
CR4	Diode, Rect. (with mtg kit)	460-1002
CR5	Diode, Rectifier	460-1004
CR6	Assy, Rectifier Bridge	468-1000
CR7	Diode, Rectifier	460-1006
CR8	Diode, Rectifier	460-1006
DS1	Lamp	482-1000
F1	Fuse, 3 A, 250 V	451-1001
K1	Relay, DPDT	410-1000
L1	Toroid	147-1000
Q1	Transistor, PNP, SW	461-1006
Q2	Transistor, NPN, SW	462-1009
Q3	Transistor, PNP, GP	461-1003
Q4	Transistor, NPN, GP	462-1004
Q5	Transistor, NPN, SW	462-1009
Q6	Transistor, NPN, Pwr	462-1003
Q7	Transistor, PNP, Pwr	461-1002
Q8	Transistor, PNP, SW	461-1001
Q9	Transistor, NPN, SW	462-1002
Q10	Transistor, PNP, SW	461-1001
Q11	Transistor, NPN, SW	462-1002
Q12	Transistor, NPN, GP	462-1007
Q13	Transistor, NPN, SW	462-1000
Q14	Transistor, NPN, SW	462-1000

Reference Designator	Description	Marantz Part Number
R1	Resistor, C/C, 470 K, ½ W	422-6472
R2	Resistor, C/C, 47 K, ½ W	422-5472
R3	Resistor, Film, 820Ω, ½ W	432-3821
R4	Resistor, C/C, 1 K, ½ W	422-4102
R5	Resistor, Film, 20 K, ½ W	432-5201
R6	Resistor, Film, 100 K, ½ W	432-6101
R7	Resistor, Film, 4.7 K, ½ W	432-4471
R8	Resistor, C/C, 2 K, 1 W	420-1000
R9	Resistor, Film, 4.7 K, ½ W	432-4471
R10	Resistor, C/C, 2 K, 1 W	423-4202
R11	Resistor, Film, 560Ω, ½ W	432-3561
R12	Resistor, C/F, 300Ω, ½ W	433-3302
R13	Resistor, Film, 15 K, ½ W	432-5151
R14	Resistor, Film, 15 K, ½ W	432-5151
R15	Resistor, Film, 560Ω, ½ W	432-3561
R16	Resistor, C/C, 56Ω, ½ W	422-2562
R17	Resistor, C/C, 56Ω, ½ W	422-2562
R18	Resistor, C/C, 47Ω, ½ W	422-2473
R19	Resistor, C/C, 47 K, ½ W	422-5472
R20	Resistor, Var. W/W, 1 K	420-1001
R21	Resistor, C/C, 47Ω, ½ W	422-2473
R22	Resistor, C/C, 2 K, 1 W	423-4202
R23	Resistor, C/C, 100Ω, 1 W	423-3103
R24	Resistor, C/C, 100Ω, 1 W	423-3103
R25	Resistor, C/C, 5.6 K, ½ W	422-4563
R26	Resistor, W/W, 0.15Ω, 2 W	436-0153
R27	Resistor, W/W, 0.15Ω, 2 W	436-0153
R28	Resistor, W/W, .08-.085Ω, 5 W	145-1000
R29	Resistor, W/W, .08-.085Ω, 5 W	145-1000
R30	Resistor, W/W, 0.15Ω, 2 W	436-0153
R31	Resistor, W/W, 0.15Ω, 2 W	436-0153
R32	Resistor, C/C, 2.2 K, 2 W	424-4223
R33	Resistor, C/C, 2.7Ω, 1 W	423-1273
R35	Resistor, C/C, 2.2 K, 2 W	424-4223
R36	Resistor, C/C, 1 K, 5%, ½ W	422-4102
R37	Resistor, W/W, 1.2Ω, 2 W	436-1123
R38	Resistor, W/W, 390Ω, 2 W	436-3393
R39	Resistor, C/F, 750 K, ½ W	433-6752
R40	Resistor, C/C, 33 K, ½ W	433-5333
R41	Resistor, C/C, 270 K, ½ W	422-6273
R42	Resistor, C/C, 47 K, ½ W	422-5472
R43	Resistor, C/C, 3.3 K, ½ W	422-4333
R44	Resistor, Film, 10 K, ½ W	432-5101
T1	Transformer, Power	440-1001
XDS1	Socket, Lamp (with mtg hdwe)	481-1000
XF1	Holder, Fuse (with mtg hdwe)	467-1001
XQ6	Socket, Transistor	468-1001
XQ7	Socket, Transistor	468-1001
XQ8	Socket, Transistor	468-1000
XQ9	Socket, Transistor	468-1000
XQ10	Socket, Transistor	468-1000
XQ11	Socket, Transistor	468-1000

PARTS LIST

Reference Designator	Description	Marantz Part Number
A1	Integrated Circuit	466-1005
A2	Assy, Comp., Ampl. Board	200-1005-3
A3	Assy, Comp., PNP Power Board	200-1011-1
A4	Assy, Comp., Bias Board	200-1003-1
A5	Assy, Comp., NPN Power	200-1012-1
A6	Assy, Comp., Rect/Relay Board	200-1013-1
C1	Capacitor, 1.0 MFD, 250 V	388-1000
C2	Capacitor, 100 PFD, 500 V	385-1001
C3	Capacitor, 125 MFD, 16 V	381-1005
C4	Capacitor, 0.22 MFD, 250 V	386-1001
C5	Capacitor, 10 MFD, 25 V	381-1000
C6	Capacitor, 10 MFD, 25 V	381-1000
C7	Capacitor, 0.1 MFD, 250 V	386-1000
C8	Capacitor, .022 MFD, 100 V	383-1001
C9	Capacitor, 150 PFD, 500 V	385-1002
C10	Capacitor, 16 MFD, 10 V	381-1004
C11	Capacitor, 47 PFD, 500 V	385-1000
C12	Capacitor, 27 PFD, 500 V	385-1005
C13	Capacitor, 5000 MFD, 50 V	381-1003
C14	Capacitor, 5000 MFD, 50 V	381-1003
C15	Capacitor, 0.22 MFD, 250 V	386-1002
C16	Capacitor, 1500 PFD, 500 V	385-1008
C17	Capacitor, ≅300 PFD, 500 V	385-
C18	Capacitor, 270 PFD, 500 V	385-1006
C19	Capacitor, 100 MFD, 6.4 V	381-1006
C20	Capacitor, 100 MFD, 6.4 V	381-1006
C21	Capacitor, 150 PFD, 500 V	385-1002
C22	Capacitor, 10 MFD, 64 V	381-1010
C23	Capacitor, 300 PFD, 500 V	385-1004
CR1	Diode, Zener	459-1000
CR2	Diode, Zener	459-1000
CR3	Diode, Rect. (with mtg kit)	460-1003
CR4	Diode, Rect. (with mtg kit)	460-1002
CR5	Diode, Rectifier	460-1004
CR6	Assy, Rectifier Bridge	468-1000
CR7	Diode, Rectifier	460-1006
CR8	Diode, Rectifier	460-1006
DS1	Lamp	482-1000
F1	Fuse, 3 A, 250 V	451-1001
K1	Relay, DPDT	410-1000
L1	Toroid	147-1000
Q1	Transistor, PNP, SW	461-1006
Q2	Transistor, NPN, SW	462-1009
Q3	Transistor, PNP, GP	461-1003
Q4	Transistor, NPN, GP	462-1004
Q5	Transistor, NPN, SW	462-1009
Q6	Transistor, NPN, Pwr	462-1003
Q7	Transistor, PNP, Pwr	461-1002
Q8	Transistor, PNP, SW	461-1001
Q9	Transistor, NPN, SW	462-1002
Q10	Transistor, PNP, SW	461-1001
Q11	Transistor, NPN, SW	462-1002
Q12	Transistor, NPN, GP	462-1007
Q13	Transistor, NPN, SW	462-1000
Q14	Transistor, NPN, SW	462-1000

Reference Designator	Description	Marantz Part Number
R1	Resistor, C/C, 470 K, ½ W	422-6472
R2	Resistor, C/C, 47 K, ½ W	422-5472
R3	Resistor, Film, 820Ω, ½ W	432-3821
R4	Resistor, C/C, 1 K, ½ W	422-4102
R5	Resistor, Film, 20 K, ½ W	432-5201
R6	Resistor, Film, 100 K, ½ W	432-6101
R7	Resistor, Film, 4.7 K, ½ W	432-4471
R8	Resistor, C/C, 2 K, 1 W	420-1000
R9	Resistor, Film, 4.7 K, ½ W	432-4471
R10	Resistor, C/C, 2 K, 1 W	423-4202
R11	Resistor, Film, 560Ω, ½ W	432-3561
R12	Resistor, C/F, 300Ω, ½ W	433-3302
R13	Resistor, Film, 15 K, ½ W	432-5151
R14	Resistor, Film, 15 K, ½ W	432-5151
R15	Resistor, Film, 560Ω, ½ W	432-3561
R16	Resistor, C/C, 56Ω, ½ W	422-2562
R17	Resistor, C/C, 56Ω, ½ W	422-2562
R18	Resistor, C/C, 47Ω, ½ W	422-2473
R19	Resistor, C/C, 47 K, ½ W	422-5472
R20	Resistor, Var. W/W, 1 K	420-1001
R21	Resistor, C/C, 47Ω, ½ W	422-2473
R22	Resistor, C/C, 2 K, 1 W	423-4202
R23	Resistor, C/C, 100Ω, 1 W	423-3103
R24	Resistor, C/C, 100Ω, 1 W	423-3103
R25	Resistor, C/C, 5.6 K, ½ W	422-4563
R26	Resistor, W/W, 0.15Ω, 2 W	436-0153
R27	Resistor, W/W, 0.15Ω, 2 W	436-0153
R28	Resistor, W/W, .08-.085Ω, 5 W	145-1000
R29	Resistor, W/W, .08-.085Ω, 5 W	145-1000
R30	Resistor, W/W, 0.15Ω, 2 W	436-0153
R31	Resistor, W/W, 0.15Ω, 2 W	436-0153
R32	Resistor, C/C, 2.2 K, 2 W	424-4223
R33	Resistor, C/C, 2.7Ω, 1 W	423-1273
R35	Resistor, C/C, 2.2 K, 2 W	424-4223
R36	Resistor, C/C, 1 K, 5%, ½ W	422-4102
R37	Resistor, W/W, 1.2Ω, 2 W	436-1123
R38	Resistor, W/W, 390Ω, 2 W	436-3393
R39	Resistor, C/F, 750 K, ½ W	433-6752
R40	Resistor, C/C, 33 K, ½ W	433-5333
R41	Resistor, C/C, 270 K, ½ W	422-6273
R42	Resistor, C/C, 47 K, ½ W	422-5472
R43	Resistor, C/C, 3.3 K, ½ W	422-4333
R44	Resistor, Film, 10 K, ½ W	432-5101
T1	Transformer, Power	440-1001
XDS1	Socket, Lamp (with mtg hdwe)	481-1000
XF1	Holder, Fuse (with mtg hdwe)	367-1001
XQ6	Socket, Transistor	368-1001
XQ7	Socket, Transistor	368-1001
XQ8	Socket, Transistor	368-1000
XQ9	Socket, Transistor	368-1000
XQ10	Socket, Transistor	368-1000
XQ11	Socket, Transistor	368-1000

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Addendum for Model 16 (100 RMS 100)

This manual is the same as the Model 16 80 RMS 80 manual except for the following:

Page 4 — Paragraph following AMPLIFIER PROTECTION, change references (2) to 100 watts to 115 watts.

either 120 vac or 240 vac (Figure 6). A fuse in a bayonet-type holder provides protection to the primary winding. One secondary winding supplies 6.3 volts for the pilot lamps. The other secondary winding delivers power to a fullwave bridge rectifier CR6, with the center tap circuit grounded (not chassis grounded). Since neither side of the bridge is grounded, the 90 to 100 volts of dc output appears as +45 to +50 volts and −45 to −50 volts, as referenced to circuit ground. Plus and minus outputs are each filtered with 5,000 microfarad capacitors C13 and C14. The filtered outputs are applied directly to all but the operational amplifier circuit, which receives plus and minus 15 volts from voltage dividers connected between ground and the 46-volt source. R10 and Zener diode CR1 provide a regulated output of +15 volts; R22 and Zener diode CR2 provide a regulated output of −15 volts. C5 and C6 filter the 15-volt source.

LOUDSPEAKER PROTECTION. Contacts of relay K1 connect the output of the amplifier to the LOUDSPEAKER terminal. Positive power supply voltage is applied to R39 and to one side of K1 coil through diodes CR7 and CR8, with the ground return of K1 coil being through R38 and relay-driver Q12. When voltage is applied through R39 to the base of Q13, base voltage rises slowly as determined by the time constant of R40 and C3. Normally, in about ten seconds, the level of positive voltage at the base of Q13 is sufficiently great to cause relay K1 to energize.

If an output fault should occur, K1 will remain de-energized during the normal time delay recycle (which happens only when the output returns to normal). If the faulty power output signal persists, as with an amplifier circuit failure, the output will remain disconnected from the loudspeakers. Relay K1 de-energizes immediately upon removal of AC power.

Page 8 — 5. Replace existing 3 amp fuse with 1½-amp, 3AGC fuse, Part No. 451-1002.
Figure 6. Change 2½, 3AGC with 3, 3AGC

Page 9 — Technical Specifications

Damping Factor . . . . . better than 100 with 8-ohm load

Total Broadband Noise (shorted input) . . . . . Better than 90 dB below 100 watts into 8 ohms

Power Output, 20 Hz to 20 kHz (each channel)

LOAD	RMS POWER	IHF (Music Power)
4 ohms	100 watts	150 watts
8 ohms	100 watts	150 watts
16 ohms	50 watts	75 watts

Overload Permitted . . . . . No limit (automatically clips any signal exceeding about 115 watts rms)

Operating (Primary) Power Requirements

NOMINAL VOLTAGE	RANGE	POWER	FREQUENCY	FUSE
120 VAC	105 to 125 VAC	300 watts	50/60 Hz	3 A
240 VAC	210 to 250 VAC	300 watts	50/60 Hz	1.5 A

Page 9 — Removal, Disassembly, Cleaning — paragraph 7.

7. Pull amplifier straight backward.

Page 13 — Maximum Power Output — paragraph F.

4. Verify that the analyzer indicates between 22 volts and 23.5 volts ac.

6. Repeat step 3, changing the audio oscillator frequency first to 20 Hz and then to 20 kHz. Output should be between 22 volts and 23.5 volts, as in step 4.

Page 13 — Harmonic Distortion Test — paragraph G.

3. Adjust the audio oscillator output level until the analyzer meter indicates 28.3 volts.

Page 14 — Short Circuit Test — paragraph H.

1. Switch back to a 4-ohm load and set the audio oscillator to 200 Hz. Adjust output level of oscillator just below clipping of the output wave as displayed on the oscilloscope.

2. Press the momentary switch (Figure 9) to a short circuit condition for no longer than three seconds. Verify the ac ammeter indicates no more than 7.0.

Page 14 — Output Relay Test — paragraph I.

2. Set analyzer to 30-volt range. Set frequency of audio oscillator to 10 Hz, and adjust oscillator output for a 28.3 volt reading on the analyzer.

Page 15 — Procedure

a. Check for shorted rectifiers CR6 through CR8; also check C13, C14.

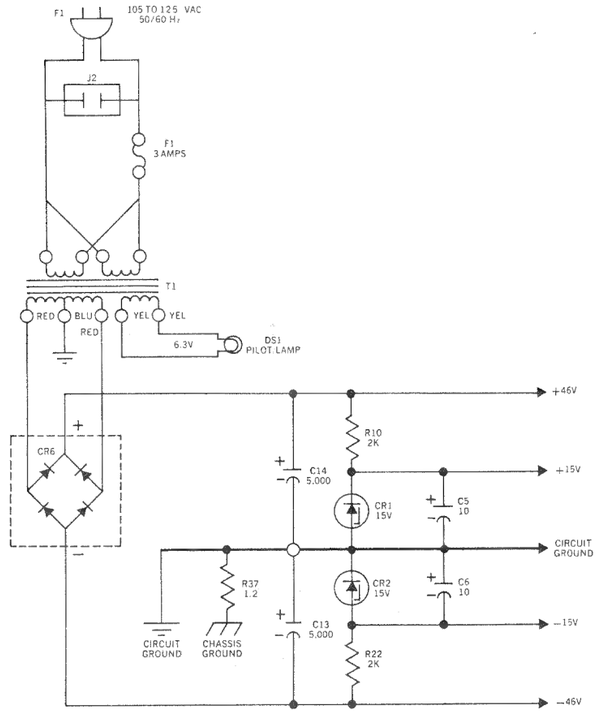


Figure 5. Amplifier Protection Circuit.

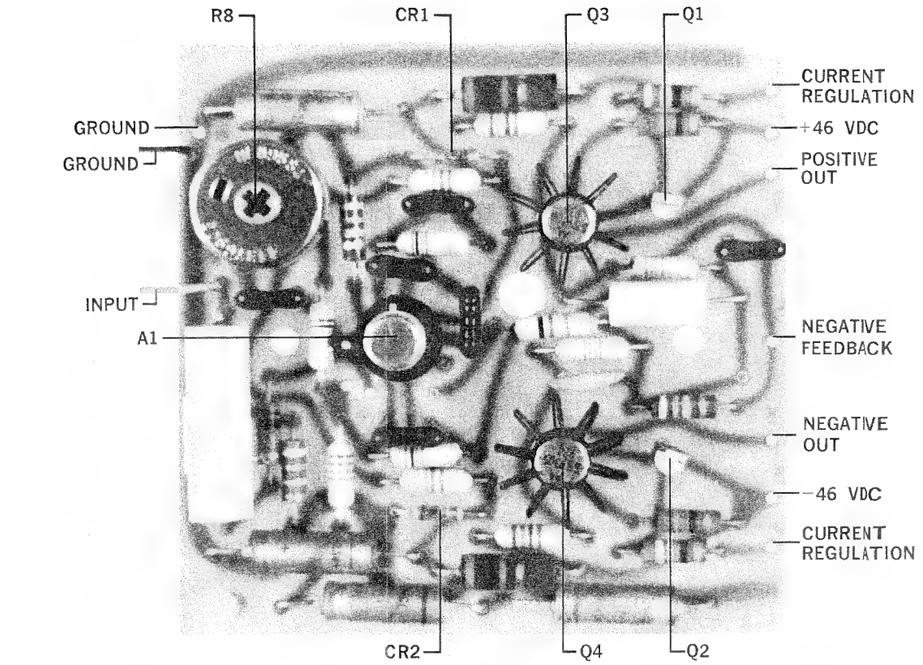
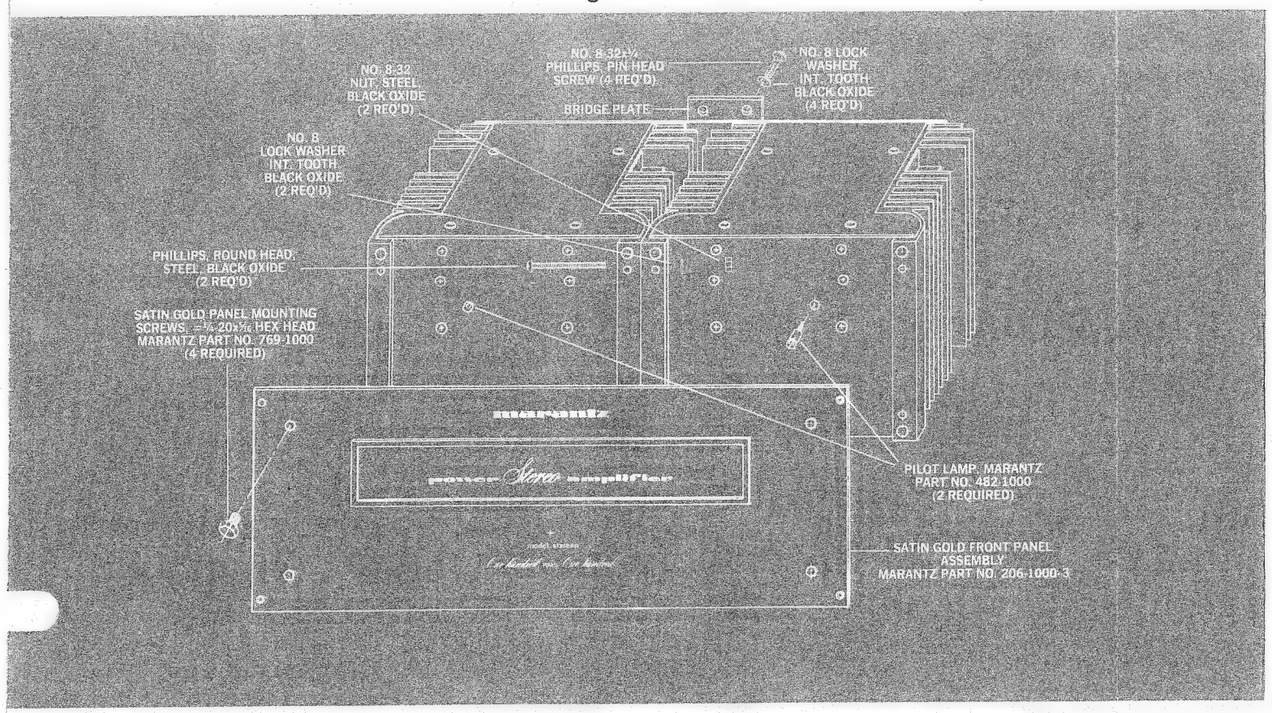


Figure 12. Amplifier Circuit Board.

Figure 7. Removal of Front Panel and Separation of Modules.



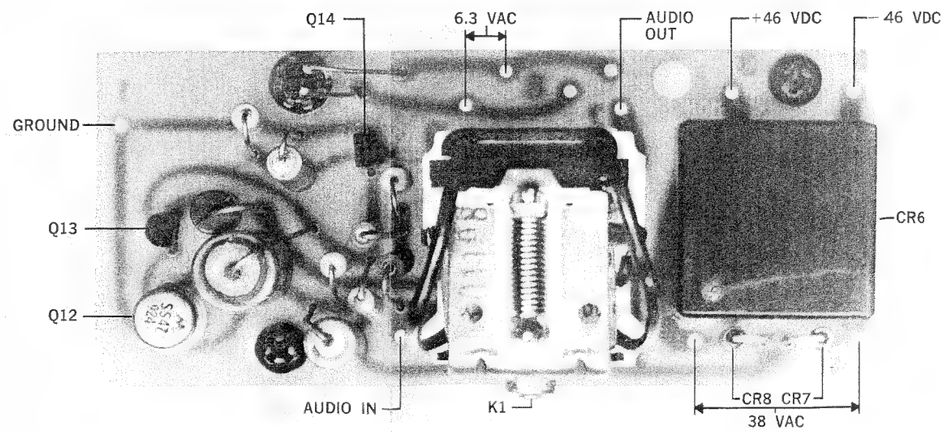
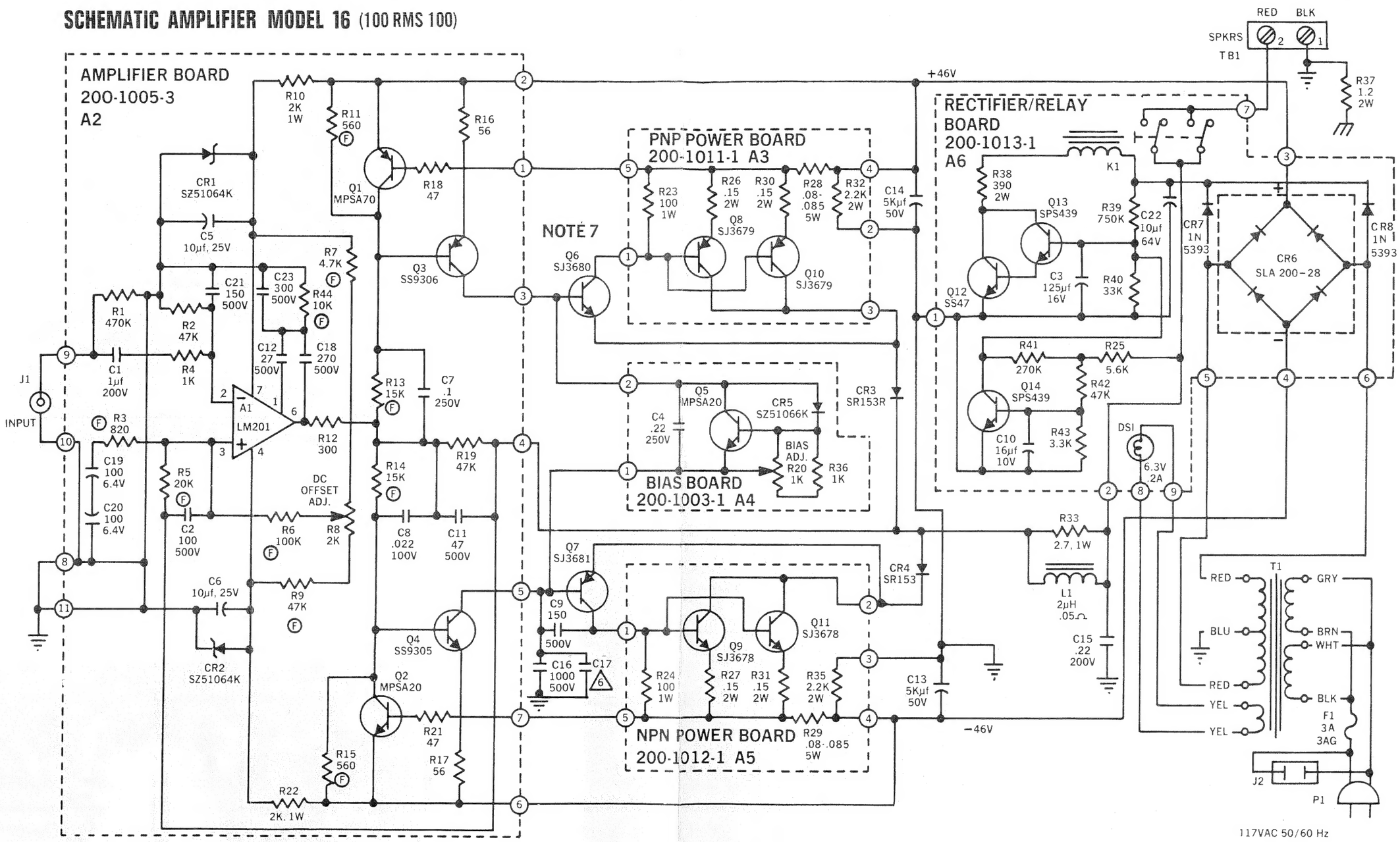


Figure 13. Relay Board.

SCHEMATIC AMPLIFIER MODEL 16 (100 RMS 100)



NOTES:

1. ALL RESISTOR VALUES ARE IN OHMS AND ARE ½ W.
2. CAPACITOR VALUES EXPRESSED DECIMALLY ARE IN MICRO-FARADS OTHERS ARE IN PICO-FARADS.
3. (F) DENOTES PRECISION FILM RESISTORS.
4. LAST REFERENCE DESIGNATION USED: A1, C23, CR8, DS1, F1, J2, K1, L1, Q14, R44, T1, TB1.
5. REF. DESIGNATOR NOT USED R34.
6. VALUE OF C17 SELECTED IN TEST.
7. APPROVED ALTERNATES FOR SJ3680 ARE FAIRCHILD PART NO'S. F0319 AND S32498.

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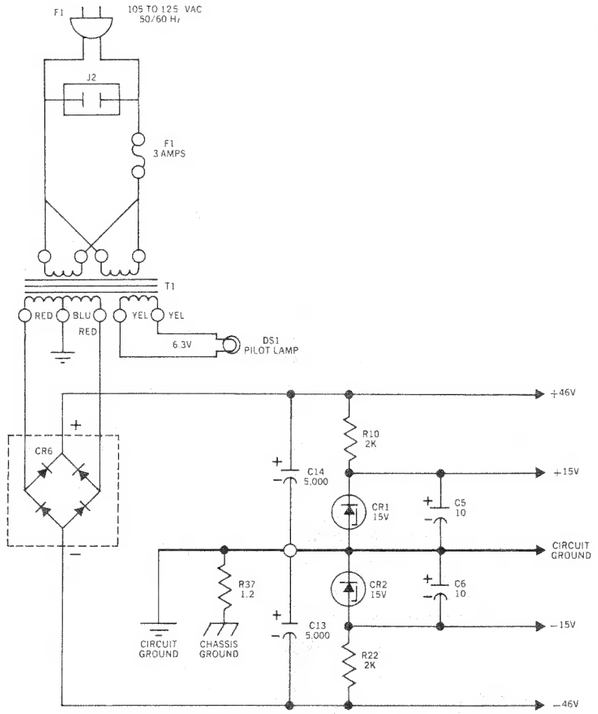

Figure 5. Amplifier Protection Circuit.

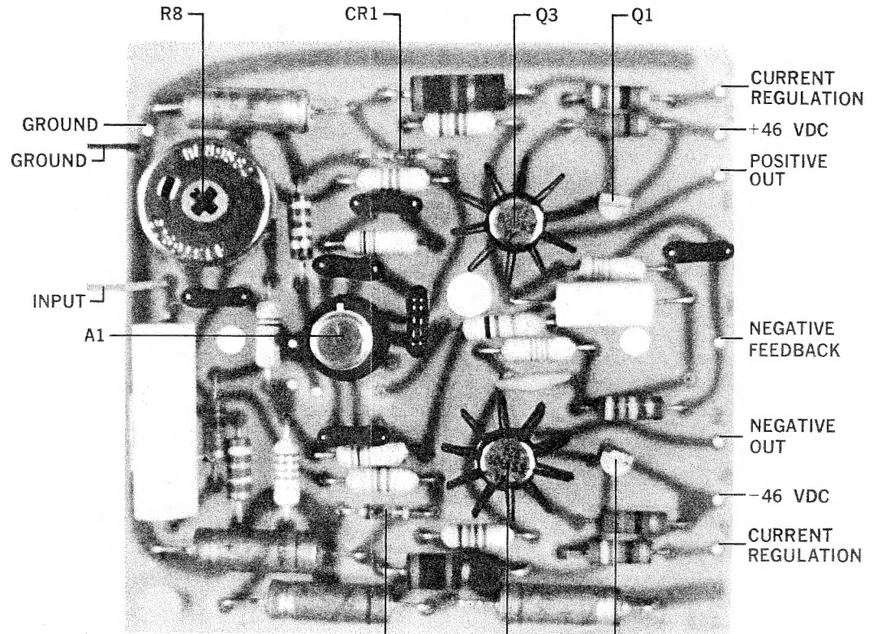

Figure 12. Amplifier Circuit Board.

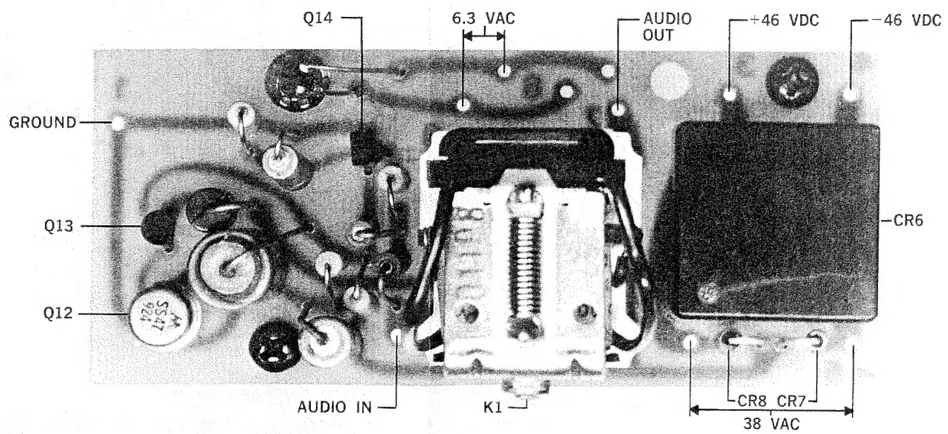

Figure 13. Relay Board.

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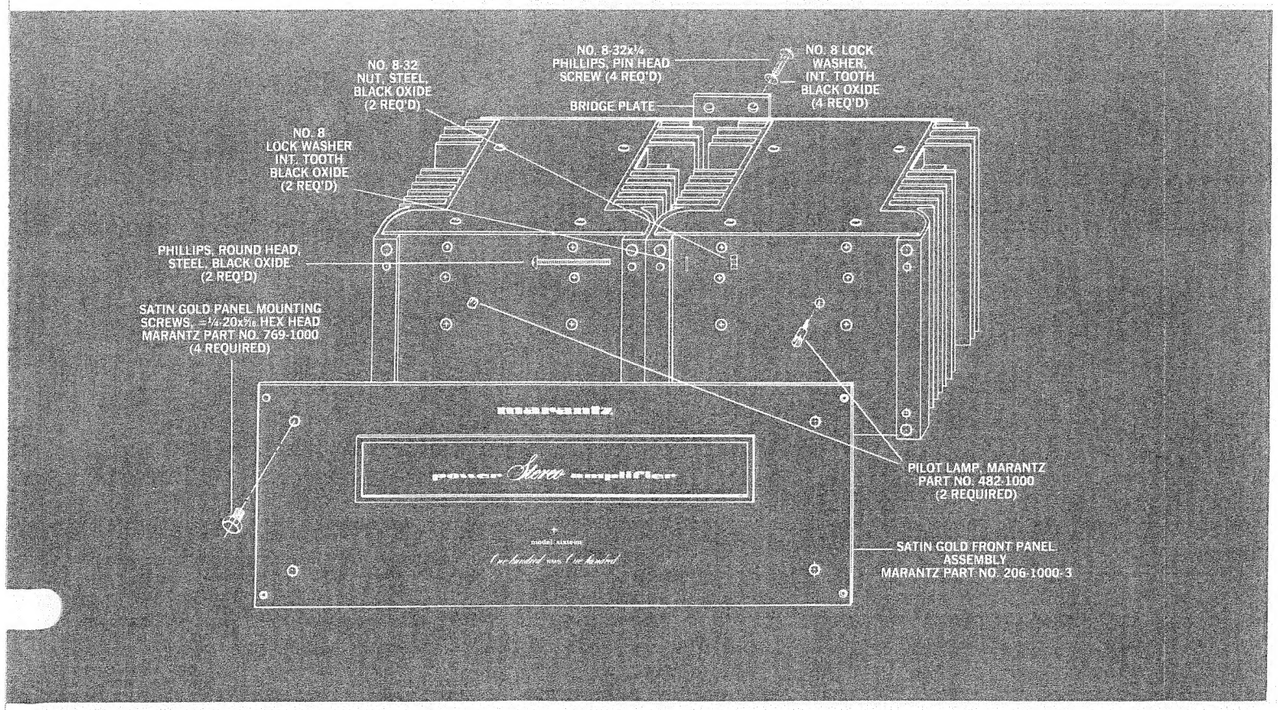
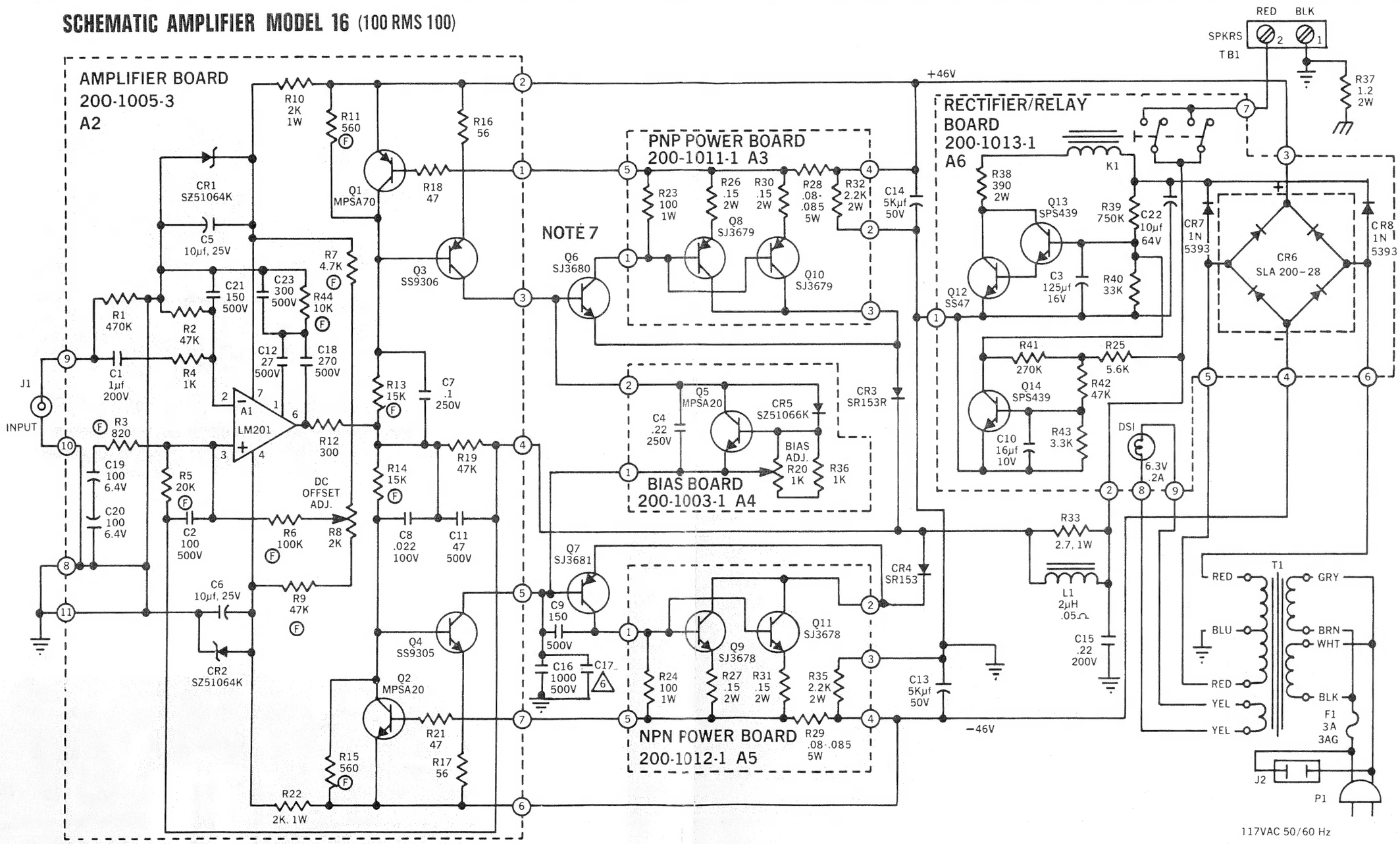


SCHEMATIC AMPLIFIER MODEL 16 (100 RMS 100)



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5. REF. DESIGNATOR NOT USED R34.
6. VALUE OF C17 SELECTED IN TEST.
7. APPROVED ALTERNATES FOR SJ3680 ARE FAIRCHILD PART NO'S. F0319 AND S32498.

100-1004 B

CHANGE RECORD

Enter changes on the Model 16 here for a permanent record. Insert pages into the manual; retain or discard old pages, as instructed.

E.C.N.* No.	Dated	Effectivity	Inserted by	Date Inserted
E.C.N. No. 1012 (Changed: R7, R9, R39, R40, R36, C3, C10. Added: C16, C15. Deleted: C12, R34)	4-17-69	S/N 1001, 1002, 1021, on.	J. Speer	June 1969
E.C.N. No. 1031 (Added: C17)	4-28-69	S/N 1-1001, on.	J. Speer	June 1969
E.C.N. No. 1039 (Added: R44, C12, C18, C19, C20, C21. Changed: C16)	5-15-69	S/N 1-1001, on.	J. Speer	June 1969

*Engineering Change Notice.